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Engineering News-Record

Devoted to Civil Engineering and Contracting
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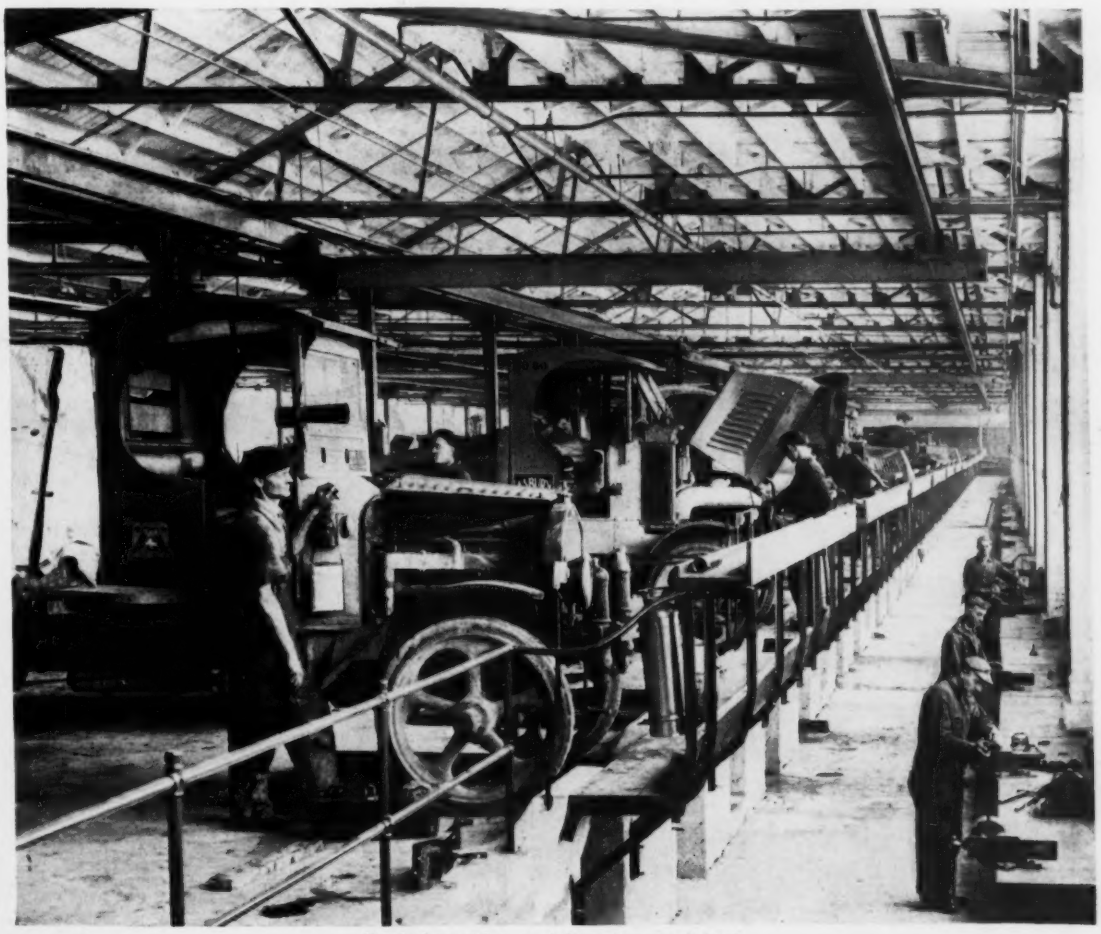

Truck shop with part of floor at repair pit level

IN THIS ISSUE: Truck and Bus Service Station at Long Island City, *another article in the industrial building series* — The Prevention of Small Wastes in Construction — Partial Evaporation of Trade Wastes Eliminates Taste from Water Supply — Trusses Carry Office Building over St. Louis Theater

Reviews of Recent Books on Engineering Subjects

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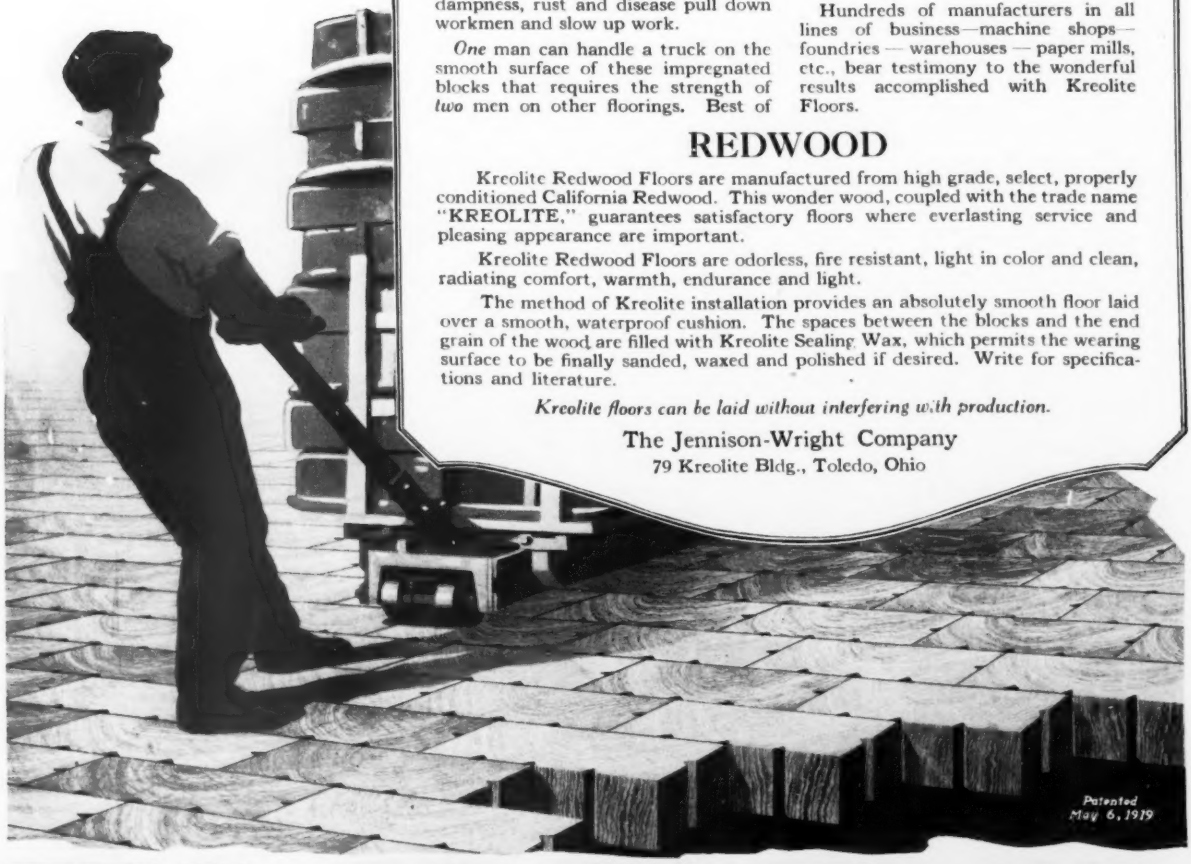

WOOD BLOCK FLOORS

A Consolidation of Engineering News, Engineering Record and The Contractor

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

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Editor

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Ten Years of Federal Aid

FEDERAL aid for public roads passed its tenth anniversary on July 11. In the decade the material accomplishments in American road building have been stupendous and federal aid money has contributed in a notable measure to the result. The statistics are available. The mileages of road to which federal aid has contributed, the amounts of federal expenditure and other figures of work done can be found in many places. It would be simple to present these figures as a record of accomplishment and they would form an impressive record. As one looks back over the years to July 11, 1916, however, it is not mileages constructed or aggregates of expenditures that present themselves as the great things done by federal aid. The great accomplishment has been leadership established in conveying the gospel of public road development as a transportation business problem. In this task the Bureau of Public Roads, which administrates federal aid, has been ably equaled and in some cases excelled by the leading road building states but for the nation as a whole it has been the standard-bearer. Because of its work the people today have nationally a higher conception of highway administration and public roads officials hold to higher practices in road construction and maintenance. This is a great thing to have done. Let us as engineers and constructors remember this and salute the Bureau of Public Roads on the passing of the tenth anniversary of its administration of federal aid.

On Time at the Expense of Safety

A DEAD or incapacitated engineman and a careless flagman—briefly that is what caused the railroad accident near Pittsburgh on June 17 which cost the lives of 16 people, according to the findings of the Bureau of Safety of the Interstate Commerce Commission. The coroner's report upon the engineman of the leading engine seems to indicate that he may have been dead or incapacitated at the time of the accident, but just what he did or did not will be always in doubt. Not so in the case of the flagman. He went out to flag, but not nearly as far as the rule book or the requirements of safety dictated. Why? Possibly because he was lazy, but more likely because he knew that if he went out the full distance and stayed until he was "called in" his train would be delayed; knew that one delay would lead to others, and that the train would be so late in getting to the terminal that the crew would be "called up on the carpet" to explain. In which case he would be the goat. True, he could say that he had only lived up to the rule, and, theoretically, he would be complimented for doing so. Actually, however, he would more likely be questioned as to whether he did not go too far or hadn't walked back when he should have run, and he would have had it impressed upon him that his train was a crack train, that if it did not run on time the public would ride on other railroads.—There is the crux of the whole matter. The public demands fast and regular service, paying a premium for it in some cases. And thereby it puts a price on safety, for delays will occur and the requirements of safety necessitate adding precious minutes to the time consumed in correcting the delay itself. Minor railroad operating officers continually are torn between the public's demand that trains run on time, reinforced by the demands of the management of their own company, on one hand, and the requirement of absolute safety on the other—and because of their persistence the former usually win. On the public mind the horrors of an accident such as that of June 17 make less impression than do the much more frequent delays which result from the efforts of train crews to prevent such accidents. Until the public is aroused to the unreasonableness of its demand in the matter of the time of trains there will be no radical change in the conditions which led up to the Pennsylvania collision.

A Needed Amendment

THAT municipalities so hampered by tax limits as are those of Ohio should be limited further by a constitutional restriction against assessing more than half the cost of street widenings and extensions against property benefited is deplorable. The underlying principle of such assessments, as the words imply, is that they shall vary with the degree of benefit that the corresponding improvement confers and that the degree should be subject to quasi judicial determination. That part of the cost of these and similar improvements—as sidewalks, sewers and water mains—should be a charge on the whole city, may be contended with considerable force but to fix it arbitrarily at half and embed it in a state constitution, or even in a state or locally-enacted city charter, is unreasonable. The voters of Ohio will soon have a chance to adopt a constitutional amendment leaving it optional with a municipality to spread all or any part of the cost of street widening over the property benefited. This is a sign of progress—greater progress still if the amendment covers other local improvements also. The voters of Ohio will do well to cast a vote for the amendment.

Construction Trespassers

EXCLUSION of trespassers is becoming an increasing care and expense in directing construction. On three large hydro-electric operations observed within a short period, guards and gates and fences were a part of the working force and equipment. These operations too were all isolated. Visitors had purposely to make a journey to get to them. Yet they came in such numbers that they were a hazard as well as a nuisance and

exclusion had to be enforced. In planning one of the working layouts the construction managers had with aforethought separated the living camp and commissary to which visitors are more common from the construction yards and buildings and the working sites. This trouble from trespassers has come upon constructors only recently. Except in the town where always there are idlers with time to be curious about any exhibition of energy the construction operation was formerly little troubled with people who were ostensibly loafers. The new ways of construction and transportation have changed customs. Modern machinery makes construction spectacular and the automobile makes it easy for people to get to view a spectacle. So the contractor has to add fences and guards to his other plant and personnel or take the chance that his noon blast will decimate a picnic. The seriousness of the condition is by no means negligible in planning construction. It has to be counted into the care and the cost.

Elimination of Tastes

ONE of the most troublesome problems that industrial plants have put up to the water-works engineers is that of combating phenol tastes. Since one part in 300 million or some other astronomical figure denoting an almost infinitesimal dilution is discernible to the taste, the chemists in the sanitary field have been at about their wits end as to how to handle a water so tainted. As phenol is a high derivative compound of coal tar the natural thing has been to look for another chemical that would neutralize it. None that is practicable has yet been found. But sanitary engineers in co-operation with chemical plant engineers or operators have, in one instance at least, examined the source and found that the taste producing constituent in the original polluting matter is so volatile that partial evaporation (10 per cent) will reduce its intensity by 96 per cent. The details are noted in this issue as worked out to free the Escanaba water supply from tastes that were particularly disagreeable in winter, when the ice cover prevented free circulation, dilution and aeration. Whether it is feasible to evaporate a portion of quench waters which cause so much of the trouble in the vicinity of steel mills is questionable but it is at least worth looking into.

Road Maintenance Costs Criticized

A SOUND criticism of road maintenance costs as they are commonly recorded is contained in the letter on another page referring to the New York State maintenance costs published in our issue of June 17. Because such records have an interest we publish them on occasion but only rarely without compunction for the misinterpretation which is likely to result. Not only do the usual records seldom indicate relative ages, as noted by our correspondent, but they almost never indicate relative traffic and often one is put to it to know whether the costs cover only pavement maintenance or include upkeep of shoulders and ditches or even whether they may not be for virtual reconstruction. Indeed there are few things which public works engineers promulgate as statistics which are more ineffectual and useless as general engineering information than the usual annual or biennial official statements of road and street maintenance costs. To the state road official himself, with a knowledge of their scope and of locality, his individual records furnish comparisons which are of considerable utility and this alone perhaps warrants their continuance, but their value extends little farther. So generally recognized are these facts that highway officials have for a number of years been working to introduce a maintenance cost accounting system which shall be logical and uniform. The interest in this activity, however, needs to be excited if progress consistent with the importance of the work is made.

From Gesture to Blow

A YEAR ago a considerable percentage of the engineering force of Chicago took a half-day "vacation" as a protest against the continued failure of the city council to grant them a salary increase. That was a gesture. A year later to a day, the gesture having produced nothing more substantial than promises, and those from the mayor and department heads with no control of the city's purse strings, a much larger number of men, organized as Local 14, of Draftsmen, Architects and Technical Engineers affiliated with the American Federation of Labor, went on strike. That was a blow. While intended only for the city council the blow hit the entire engineering and architectural profession as well. The council was sufficiently impressed, whether convinced in fact or against its will, to grant the demand. How lasting the effects of the blow will be on the council is uncertain, but it will be a long time before the engineering profession, in and out of Chicago, will recover from its effects.

We say this in full sympathy with the engineers at Chicago and elsewhere who are serving the public at inadequate and unfair salaries, but with a feeling that the way out of their difficulties is not by the strike route. That way will not lead either city council or the public to value the engineer and his services at their true worth or to put the engineer where he belongs with other professional men. Rather it will strengthen the all too common notion that the engineer is at best a more or less skilled laborer who should be paid accordingly—or at a lower rate, from the politicians' viewpoint, because of his relative unimportance as a voter and vote getter.

Organization of engineers for their individual and collective advancement as professional men we have always advocated. We have also persistently stood for due compensation for services rendered, but not through the union route—heartily as we appreciate the aims and achievements of organized labor when wisely directed.

To any claim that the Chicago engineers' strike was a necessary weapon of last resort it may be replied—without admitting the justification of the use of such a weapon, which admission would carry various implications as to vested rights of position and compensation—that it is not clear that the pay increase might not have been obtained by other means or that it was the strike so much as the justice of the claims for more pay that won the increase when once brought before the entire council. We have seen no evidence that, prior to the strike, the engineers' campaign for increased pay was thoroughly planned and executed for the purpose of winning not only council but also public support.

There can be no question but that a campaign for

the enlightenment and support of the public in such matters is a proper function of engineers and engineering organizations.

We have saved to the last the strongest objection of all to the strike of the Chicago engineers and to any strike of city or other public employees. All such acts are contrary to the spirit and practice of representative government and as such are to be condemned. That this is common opinion among both municipal and other government employees is shown by the rarity of such strikes and by public condemnation on the few and unsuccessful occasions when they have occurred. Anarchy, not order, will be on the way when any group of governmental employees can dictate wages, hours and other conditions of service to a properly constituted body provided by law to meet the needs of the entire body politic rather than some portion of it which occupies key positions.

State Water-Power Permits

OUT of the long controversy over the proposed immense water-power development on the New York-Ontario stretch of the St. Lawrence River there has emerged a report on proper terms for a permit—if the project is carried out by private interests rather than by the State of New York. These terms, embodied in a report made to the New York Water Power Commission by Roy G. Finch, state engineer, are of general interest because of the size of the project, the controversy it has caused and, of more importance, because they are based on sound principles which conserve the interests of the three great parties concerned in all such cases—the state, the private company, and the public.

These principles, which are also applicable to many muncipal franchises granted to private utilities, relate to the life of the permit or franchise, recapture and ultimate public ownership, amortization, rate control and rentals to be paid to the public treasury.

In the case of St. Lawrence water power, Mr. Finch states, the life of the permit cannot exceed fifty years. As a rule, this is long enough and in some cases it would be too long for the life of a grant of rights to a quasi-public corporation. It is none too long in the case in point, in view of the size and cost of the enterprise and the fact that all rights revert to the state at the end of the permit and the physical plant also becomes the property of the state.

It is not enough to have the franchise and physical plant vested in the commonwealth at the end of fifty years; especially in the case of great natural resources and the present state of public opinion as to their retention, development and operation, by the state or city rather than by private interests. The city or state should always have the right to assume ownership and operation, on reasonable notice and for just compensation, the terms of both to be specified in the grant. Mr. Finch proposes that the state have the right to buy the physical property in question on completion or any time thereafter on five years notice, the price to be actual cost, less the amortization fund, plus 15 per cent. Presumably the method of determining both actual cost and the annual contributions to the amortization fund will be carefully worked out and incorporated if and when a St. Lawrence power permit is granted. The specification of as much as a 15 per cent addition to cost in case of purchase may be questioned by some guardians of the public welfare, especially as its purpose is defined as being to provide means of meeting the debts and other obligations of the licensee in case of purchase by the state, but it is to be remembered that the 15 per cent is to apply only after the amortization fund has been deducted.

Provision for an amortization fund deserves special commendation but it needs to be safeguarded both as to the amount of the annual increments, as already suggested, and as to its relation to rate determinations. Compulsory use of the amortization fund to reduce the capital account with corresponding adjustments as to purchase price, needs consideration.

Any well informed, fair minded and well balanced person, whether looking at the matter from the public or private viewpoint, will agree to the proposal to lodge rate control in the state public service commission. The exact meaning of the preference as to rates which it is proposed municipalities be given needs clarification.

The provision for periodic revision of the license fees for water power used is an essential to fair dealing all around. The basis for these adjustments and the corresponding public control body needs to be more specifically stated. Presumably, the Water Power Commission will act for the public on license fee adjustments but conceivably this should or might be tied in with rate adjustments; although the latter will have to be based in part on the amounts paid the state annually per unit of power utilized.

A few words may be said as to the wisdom of a license fee instead of using an equivalent sum for the lowering of rates to consumers. If all the taxpayers of the state were to be consumers of electric current there would be less call for a license fee; but however far and wide St. Lawrence current may be distributed taxpayers and consumers will never be identical in person, much less correspond in volume of taxes paid and current used. Hence the reason for a license fee for the benefit of the whole state. Moreover, who can say how much of the power will be sold in and how much outside New York State, including Canada? This question suggests others of an interstate, federal and international character that are recognized but not taken up by Mr. Finch in detail and not within the scope of this discussion.

Finally, those not fully informed on the subject should be given more than the hint conveyed in our opening sentence that it is by no means settled whether and if ever just when New York State will grant a license for St. Lawrence water-power development. The matter has long been one of keen political controversy and quite aside from the strong political opposition to any grant is a widespread popular desire, if not demand, for state development and ownership of water power, some of which would be well if not better content to stop with ownership rather than going on to operation as well. Prophecy as to the outcome of this long controversy just as an election is pending is futile. All we have wished to do is call attention to the terms of a permit which would safeguard the interests of all concerned in case the decision is finally for private development, a task all the more justified and pleasurable because so many elements of the proposed grant deserve consideration wherever either water power permits or municipal utility franchise grants are or may soon be pending.

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

Truck and Bus Service Station at Long Island City

Concrete Building With Slab and Steel Truss Roof—Entrances at Two Levels—Ramps Between Floors—Load Diagrams—Mechanical Handling Plant—Features of Other Stations

By Elwyn E. Seelye
Consulting Engineer, New York, N. Y.

In carrying out a policy of erecting its own service stations at important points throughout the country, the Mack Trucks, Inc., has completed large stations of this kind at Long Island City, Boston, Chicago and Los Angeles. The provision of facilities for efficient handling of service on motor trucks and buses in a large metropolitan center requires a thorough study of all the factors involved, from selection of site to final equipment of building. Such a problem was presented in the case of the Long Island City service station and utility building, which will care for about 265 vehicles, exclusive of work in the body shop. Fig. 1 is a general view of this station and Fig. 2 a view on the main floor.

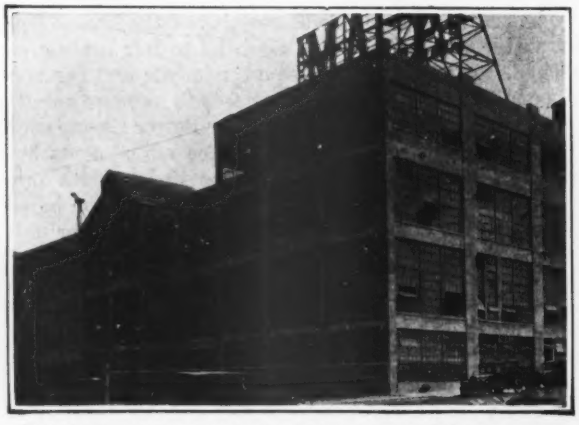


FIG. 1—TRUCK SERVICE STATION; LONG ISLAND CITY
Rear and Honeywell Ave. side. Note wide entrances from storage yard in rear.

Selection of Site — Studies made on the area of Greater New York resulted in the selection of a location in Long Island City for the new structure, the determining features being: (1) Present distribution of the company's trucks in the area to be served; (2) future distribution determined by a forecast of fifteen or twenty years; (3) relation of the location to the initial and ultimate facilities to be provided by the company's service stations and to its co-ordination in a future plan of development of the company's business in the metropolitan district; (4) a location convenient to the general executive offices on account of special utilities to be housed. These problems were analyzed along lines familiar in city-planning engineering.

The next problem was to secure a site which would facilitate the handling of a large capacity of motor trucks and buses in a multiple-story building without the use of elevators. In the site selected the grades allow direct entrances for vehicles to the basement and the first floor and with a ramp less than a story in height to the second floor (Figs. 3 to 5). The station occupies the block bounded by Anable and Nelson Aves. and Honeywell and Moore Sts.; a developed profile of the street surface along each side is given in Fig. 6.

General Description—The design of the building was based on providing complete facilities for the various operations to be housed, with the most modern equipment for operation, light, ventilation and hygiene as adapted to an industrial type of building on a strictly utilitarian basis, with esthetic features eliminated. On this site, 200 x 600 ft., the initial building is 200 x 425 ft., and contains a floor area of 272,000 sq.ft., distributed as follows: Basement, 87,000 sq.ft. for stock room, storage, engineering laboratory and boiler room; first floor, 85,000 sq.ft. for service work; second floor, 77,500 sq.ft., with a shop for special bodies; third floor, 22,500 sq.ft. for offices and drafting room. A storage yard on the basement level is available for a future extension to the building. To develop it for present use, a retaining wall has been built along the high side, which will become the foundation wall of the future building. The main yard driveways have been paved with 6-in. reinforced concrete and the intermediate areas with cinders having an asphaltic binder. This yard is drained by catchbasins.

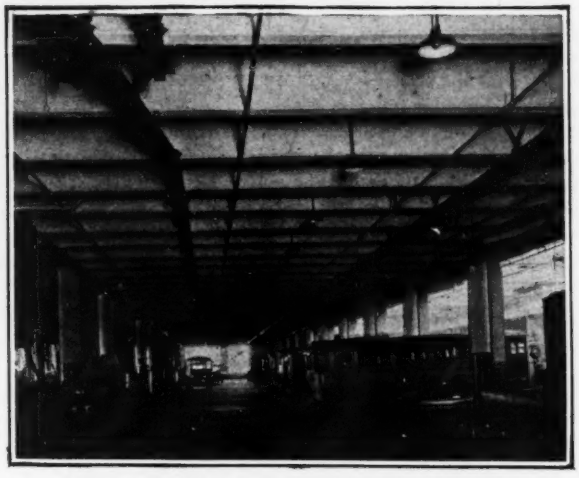


FIG. 2—MAIN FLOOR OF TRUCK GARAGE
Interior of 40-ft. bay. Transverse beams carry slab of second floor. Overhead runways for trolley hoists. Court with skylight at right. Repair shop at left.

All truck movements between different levels are by ramps 20 ft. wide. The basement has one rear entrance at grade, one driveway platform entrance and one ramp to the front street (Fig. 6). The main floor has three entrances at grade and one ramp to the second floor, with provision for another ramp if required. The grade was held to 12 per cent where practical, but for the ramp serving the body shop it is 16 per cent, as crippled trucks are not likely to be handled. These ramps end in vertical curves at the top to provide clearance for long buses.

Layouts and Facilities—On the first floor, Fig. 5, the inspection shop, which is a clearing house for new work

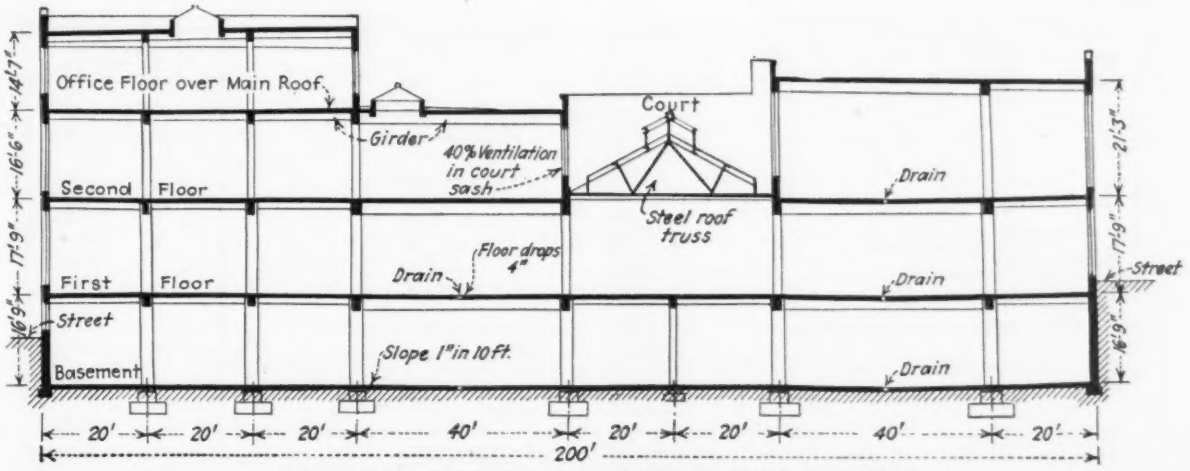


FIG. 3—CROSS-SECTION OF TRUCK AND BUS SERVICE STATION

and finished work, is arranged with an office enclosure between an entrance and an exit. Near the office are located the gasoline and oil supplies for the repair trade. This shop has a quick capacity of about twenty-five trucks, which can be largely increased by overflowing through the wide doors in the rear, opening into the main aisles of the service areas beyond.

The service areas on two floors include forty working bays, each capable of accommodating two trucks, or 80 vehicles at one time. The equipment for the repair of trucks and buses includes work benches, compressed air, hose connections, electric power, overhead cranes, good daylight, electric light, heat, natural and forced ventilation, and direct attachments for engine exhaust gases and car wash stands. Storage areas exclusive of the yard have a capacity for 160 vehicles and are equipped with electric light, water, compressed air and car wash stands.

The service areas are supplemented by the machine shop, motor overhaul, parts cleaning, blacksmith shop, tool rooms and radiator room, all containing gas and steam fixtures as well as the equipment mentioned above. The parts department embraces a stock room, customers' office, accounting office, receiving platform and elevator and dumb-waiter service.

The body shop, for making to order other than stock bodies, occupies the entire second floor and comprises the main body shop, blacksmith shop, ladder department, paint room and varnish room. It has a clerestory or monitor roof to enable a truck body to be lifted over a chassis by means of cranes. Its equipment includes electric power, electric hoists, forges, compressed air, special heat for the varnish room and wash stands. The experimental laboratory is equipped with dynamometers, gas, a transformer, compressed air and hot and cold water. The engineering department, housed in a story above the main roof, contains offices, drafting room, blueprint rooms and photography room. The branch manager's office, accounting office and telephone switchboard are also in this pent house.

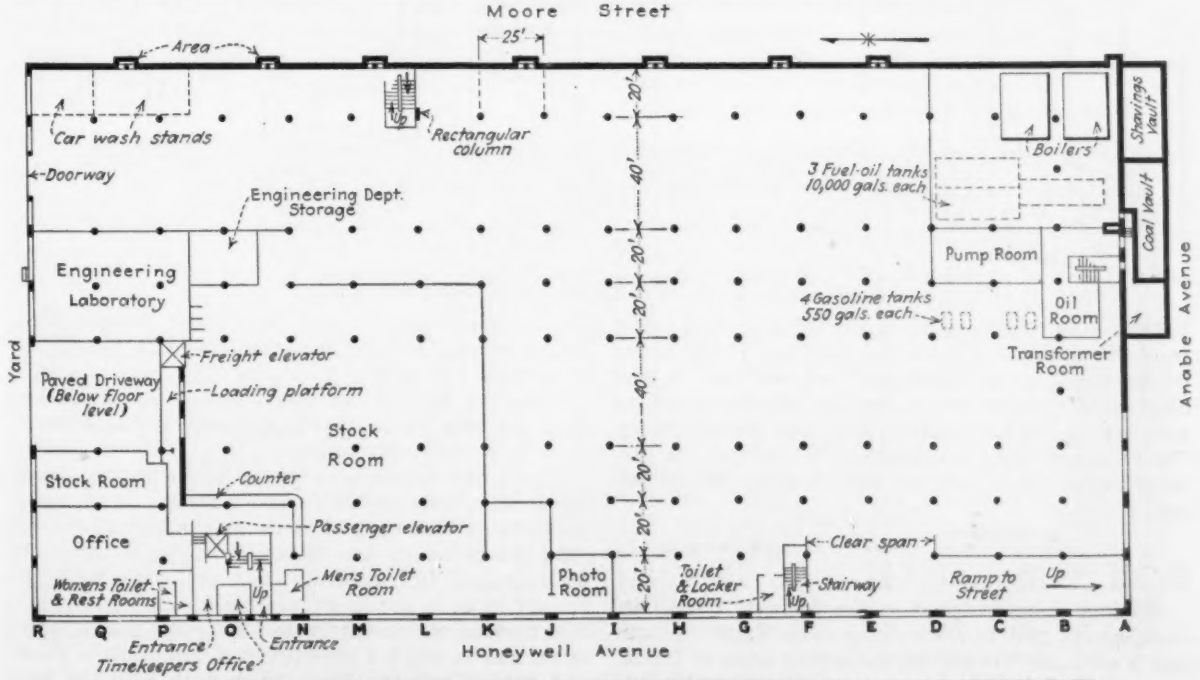


FIG. 4—BASEMENT PLAN SHOWING COLUMN ARRANGEMENT PROVIDING LARGE WORKING BAYS

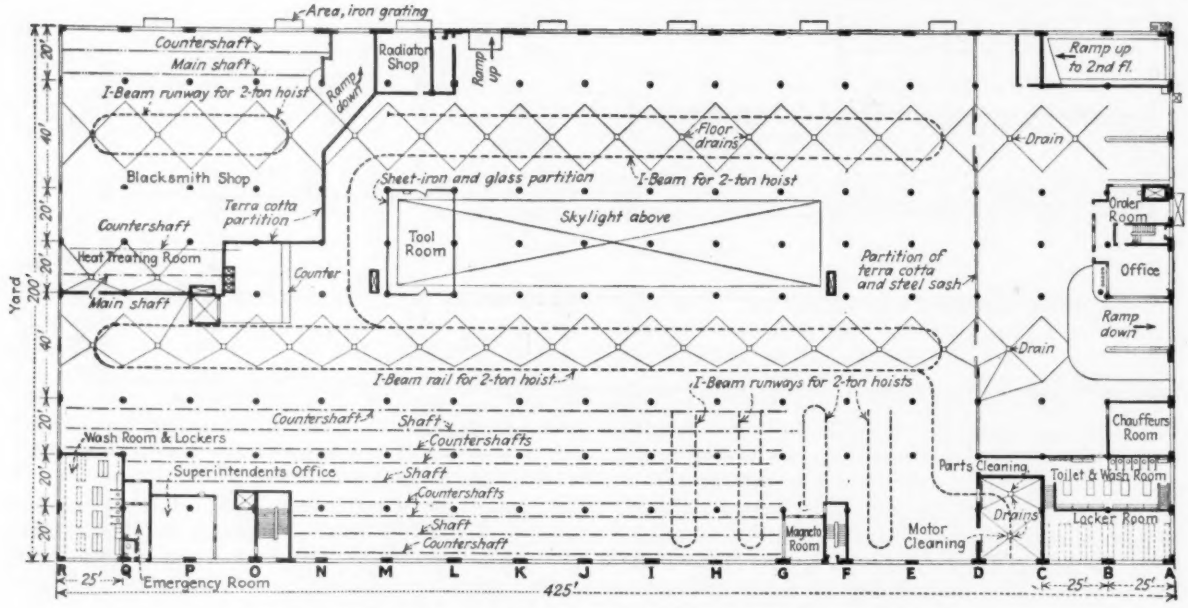


FIG. 5—FIRST FLOOR PLAN SHOWING SERVICE AREAS AND OFFICES

Structural Design—The building is of reinforced concrete, with girder framing to support slab-and-beam floors and roof. The typical construction has a 5-in. slab with beams spaced 6 ft. 3 in. c. to c., Fig. 2. Columns are spaced 25 ft. longitudinally; transversely there are six 20-ft. bays for the working areas and two 40-ft. bays for the aisles. In the main floor areas the entire slab is dished about 4 in. in each panel, sloping to a central drain opening connected with horizontal drain pipes under the ceiling. The depth of cross beams is reduced correspondingly.

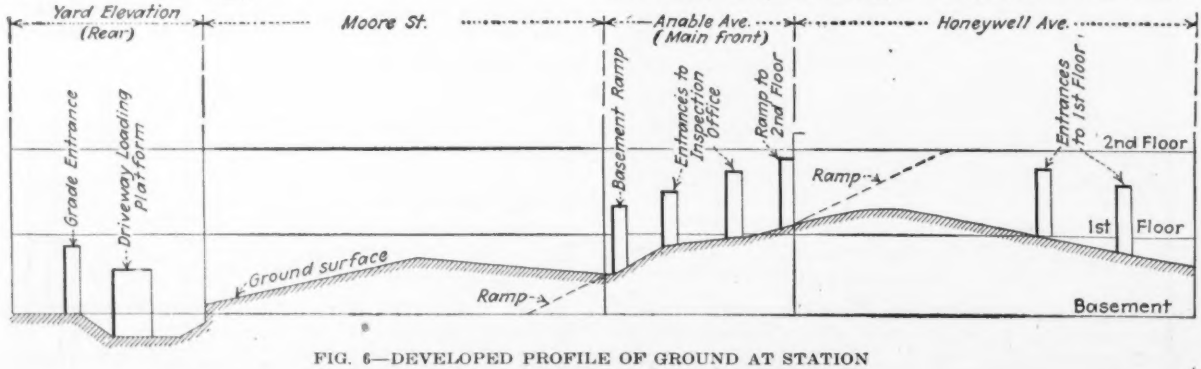


FIG. 6—DEVELOPED PROFILE OF GROUND AT STATION
Shows varying level of ground surface, with several entrances

The ruling load to be taken care of comprises motor trucks weighing 3½ tons on rear axle and 7½-ton loaded trucks, the latter with a 50 per cent overload. A load diagram is given in Fig. 7, together with the grouping assumed for the main service floor and the body shop. The results of these groupings gave live-loads for different spans as follows, the figures being pounds per square foot:

	Beams		Slab	Girders 40x20 and 20x20 Ft.
	40-Ft.	25-Ft.		
Main floor.....	120	250	650	120
Body shop.....	120	150	650	120

Members were designed on the basis of these live-loads, except that to allow for possible heavier groupings a minimum live-load on the service areas of 190 lb. was used, and then the beams were strengthened where it was found that possible arrangements of loaded trucks might cause higher shear or moment. Slabs were designed on the basis of a maximum wheel load of 13,000 lb. distributed over a strip 5 ft. 6 in. wide, with continuity both longitudinally and transversely of the span of the slab. Impact stresses were taken up in the safety factor.

The above figures, which are general or approximate, provide a considerably stronger floor slab than is common practice in garages. By the use of the variable live-loads, adequate strength was provided with a saving of about $60,000 over the cost of designing the beams and girders for the ruling live-load on the beams of 250 lb. per sq.ft. A quick-setting high-aluminum cement was used in one case where it was desired to load concrete before portland-cement concrete would have been completely cured.

Floors and Roofing—To give a hard and dense wearing surface, the concrete floors are given a 1½-in. monolithic finish consisting of equal proportions of cement, sand and grit. On the ramps the wearing surfaces are strengthened by cast-iron grids set flush with the cement finish in a strip 30 in. wide for each wheel path. The washing stands for trucks are formed with a recess in the slab in which a waterproofing membrane is placed and covered with a cement finish flush with the floor

surface. These stands are equipped with hose racks. The toilet room floor is covered with a cement layer treated with a hardener. A feature of the com-

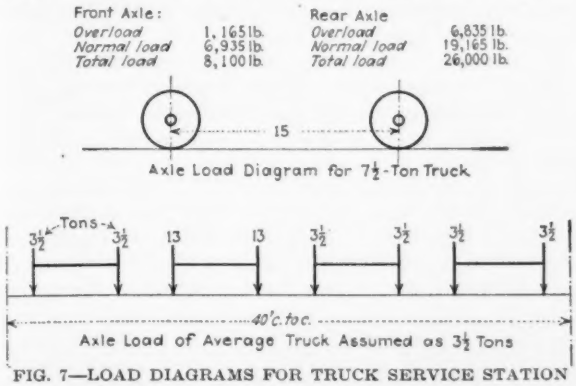


FIG. 7—LOAD DIAGRAMS FOR TRUCK SERVICE STATION

position roofing is the use of slotted terra-cotta blocks in the concrete walls to avoid the use of metal flashing. Skylights are of the wire-glass puttyless type.

Walls, Windows and Doors—The exposed concrete on the exterior of the building is given a rubbed finish for appearance and to resist the effects of weather. The interior walls below the dado were finished with a special green enamel not affected by lime or dampness in the fresh concrete. Above the dado, the walls, columns and ceilings were coated with a white coldwater paint in order to give a hard and washable non-glare surface, unaffected by the alkalies of cement and masonry. Plaster finish for the walls is used only in the offices and on one side of the blacksmith shop where it was required by insurance standards.

Interior partitions are of terra-cotta blocks, smooth on both sides. In some places this block work is only 3 ft. high and is surmounted by steel sash. Stairs are of concrete, with wearing treads for those in the towers, which are used the most. Cast-iron guards are provided at main exterior doorways, while all joints and exposed corners are protected by steel channel bucks or angle guards. Interior columns are protected to a height of 4 ft. by cylindrical jackets of No. 12 steel, which were placed in the forms.

Steel sash for the curtain walls, built into the concrete, is glazed with ¼-in. factory ribbed glass to a height of 8 ft. from the floor, with clear glass above. The glass is set with the ribs vertical and on the inside to facilitate cleaning, except that in the paint shop the ribs are placed outside, as it is easier to clean the paint spray from the smooth surface. For sash not accessible from the ground, the jambs and mullions are provided

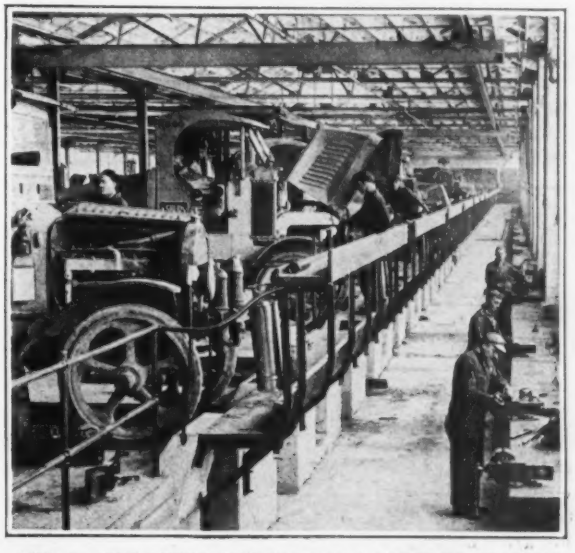


FIG. 8—TWO-LEVEL FLOOR IN LOS ANGELES STATION
Part of floor at right is dropped to level of repair pits

with holdfasts for the window cleaner. Ventilating panels of the sash are center pivoted, but top pivoted in the offices to permit the use of shades and screens. Rolling shutter doors of copper-content steel, electrically operated, are used at exterior doorways for trucks, while the exterior doorways at the receiving platform have hand-operated counterbalanced doors which slide upward. Ordinary openings throughout the building are fitted with tin-clad underwriters-label doors; for widths up to 4 ft. these are swinging doors, but a sliding type is used for greater widths.

Light and Power—Since the lot slopes in two direc-

FIG. 9—TRUCK SERVICE STATION AT LOS ANGELES
Concrete two-story building with steel roofed shop in rear

tions, the basement is completely below ground at the highest corner and above ground at the lowest corner (Fig. 6). The dark area was utilized for storage and the boiler room, and the lighted area for the stock room. The main floor is well lighted by windows on all sides and by a skylight 40x200 ft. over the central area. Windows have sills only 18 in. from the floor, in order to throw the light under the work benches along the walls.

Service bays generally back up on work benches over which there are drop lights. In addition there are four 150-watt ceiling lights and two column plugs for extension lights in each bay, the lamps being spaced to throw the light between the trucks instead of on top of them. The circuits are so arranged that groups of four lights can be cut on or off as required, and they are also controlled at the panel switchboards. Aisles are lighted by alternate circuits, with 100-watt lamps spaced 12½ ft. c. to c. The stock room has 100-watt extended ceiling lights 8 ft. c. to c. over the aisles of the bins, with twin sockets for cord extension lights. The office spaces have lights suspended 9 ft. above the floor. All lamps in the working spaces have enameled iron reflectors and are dropped far enough to clear shafting and sprinkler pipes. Current for power purposes is supplied from a transformer vault located under the sidewalk and having two high-tension service feeders, each of sufficient capacity to supply the entire load.

Heating and Ventilation—Steam heat on a low-pressure system with vacuum return is supplied by wall radiators, but the boilers carry high pressure to permit supplying steam for power or manufacturing purposes. Of the four 175-hp. boilers, two are for oil fuel, one for coal and one for shavings. Three 10,000-gal. fuel oil tanks are installed under the basement. With outside temperature at zero this plant is designed to maintain a temperature of 60 deg. F. in the main service areas, 70 in the offices and 80 in the varnish room.

Windows provide 40 per cent of the ventilation. An exhaust fan with ducts and openings on the ceiling and walls serves the spaces where gasoline motors are operated and provides two changes of air per hour. To take care of running motors, there is a fan-operated suction exhaust system, to be directly connected to the motor exhaust pipes, with a capacity of 5,600 cu.ft. of air per minute and a suction pressure of 4 oz. per square inch. Intake fans may later be placed under the windows, discharging along the floors. In the offices, the ceiling is furred and provided with registers, the space above having automatic rotary ventilators.

Miscellaneous Equipment—A passenger elevator of 2,400-lb. capacity, with a speed of 200 ft. per minute, serves the offices. Goods are handled by a 3-ton elevator at 50 ft. per minute and by three automatic dumbwaiters of 350 lb. capacity and speed of 100 ft. per minute. Parts are handled on the main floor and blacksmith shop by 2-ton trolley hoists on I-beam runways suspended from the ceiling, Figs. 2 and 5. The sprinkler system is served by a 50,000-gal tank on a tower formed by extending four of the interior columns. There is also a 4,000-gal. roof tank for house or plumbing supply. The fire equipment includes fire hose and an automatic annunciator and a sprinkler alarm system.

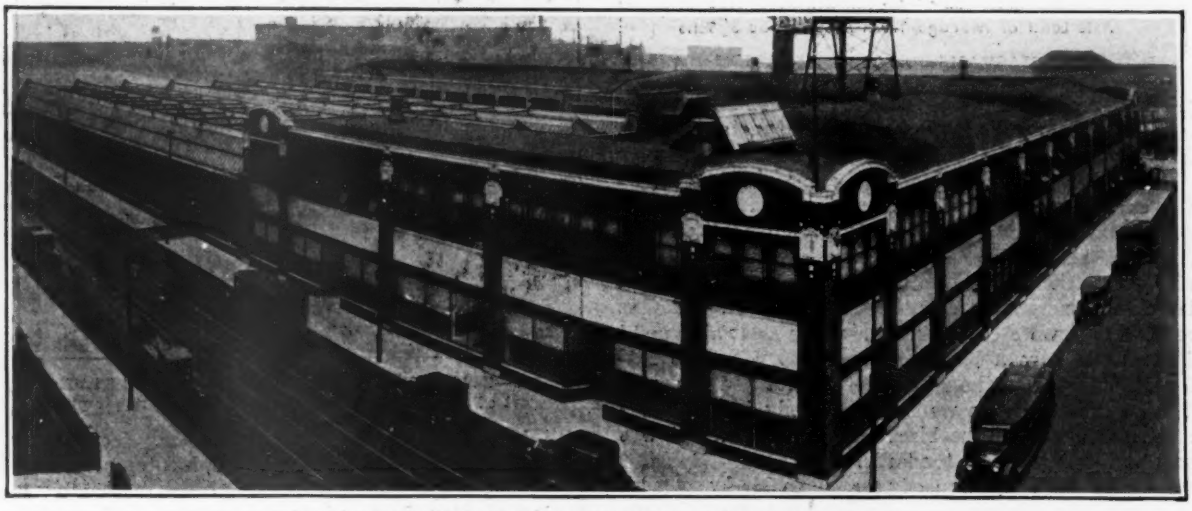


FIG. 10—CHICAGO SERVICE STATION: MACK TRUCKS, INC.
Steel shop building at left has longitudinal sawtooth skylights carried by transverse trusses. Concrete office and truck storage building at right.

All plumbing pipes are of steel and are exposed for convenience and economy in renewals. Gasoline tanks for 2,200 gal. capacity and kerosene tanks for 550 gal. are located under the basement floor, while oil tanks for 1,080 gal. are in the oil room in the basement. All tank outlets are in the outer office on the main floor, the supply being controlled by hand pumps having their cylinders in the basement. An oil salvage system discharges through a filter to the fuel oil storage tanks.

Engineers and Builders—The general features of the Long Island City service station were formulated by George H. Hodges, vice-president of the Mack-International Motor Truck Corporation, New York, in co-operation with the heads of the various departments. The writer acted as consulting engineer, while the building was designed and supervised by H. C. Lamb, engineer in charge for the writer. The mechanical features were designed by J. F. Musselman. The general contractor was the H. D. Best Co., with J. L. Murphy, Inc., for the heating and plumbing, H. G. Vogel Co. for the sprinklers, and the Lord Electric Co. for the electrical equipment. All these are New York firms. The total cost was about $960,000, including the mechanical equipment and the yard retaining wall and pavement.

Other Service Stations—Mention has been made of the company's service stations at Los Angeles and Chi-

cago. A special feature of the former is a bi-level shop, shown in Fig. 8. This new arrangement is an evolution from the usual repair-pit; it has the advantages of better ventilation, easy access and convenience for the mechanics. In this station, Fig. 9, the two-story and basement structure is of reinforced concrete of the flat-slab type, with about 185,000 sq.ft. of floor area. Beyond this is a one-story brick and steel building with saw-tooth roof and having 85,000 sq.ft. of floor space. The architect was John M. Cooper, Los Angeles, Calif.

In the Chicago building, Fig. 10, there is a similar combination of concrete and steel construction, but here the sawtooth skylights run lengthwise of the shop, while the trusses extend across it, thus requiring trusses in which the top chord is exposed above the roof. Over the second floor of the two-story concrete building the roof is carried by steel bowstring trusses, thus eliminating all interior columns and giving maximum flexibility in the use of the storage space. On this floor, offices occupy about 5,000 sq.ft., while 50,000 sq.ft. are used for truck storage.

A ramp of 15 per cent grade serves the second floor. By locating the basement boiler room under the ramp it is provided with light and ventilation without using areaways or elevating the first floor. In the bi-level shop, the pits are placed at an angle in order to permit a long chassis to stand clear of the aisles. Fresh air, either cold or heated, is introduced by ventilating units. In addition, there are exhaust ducts under the floor to carry off engine exhaust gases. Mechanical handling equipment includes tramrail cranes and monorail runways in the stock room, repair shop and machine shop. For this service station the architect was S. Scott Joy, Chicago.

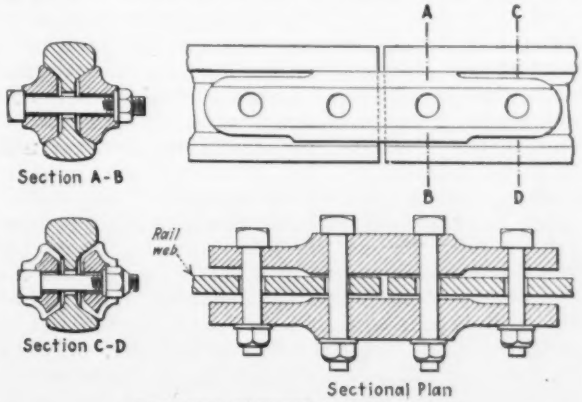
Rail Joint Practice on Foreign Railways

Various Designs—Bridged Type Generally Favored for Main Track—Hinged and Boltless Joints—Fractures of Bars

THAT the rail joint is the weakest part of the railroad track structure was one of the final conclusions adopted by the International Railway Congress of 1925, on the basis of extended reports from various countries. The joint was pointed out also as an important but secondary cause of rail breakage, due to the shocks produced at the joint by heavily loaded wheels. It was considered advisable, therefore, to suggest two methods of reducing these troubles: (1) by increasing the length of rails in order to reduce the number of rail joints, and lengths of 45 ft. to 78 ft. 9 in. are common in Europe; (2) by improving the design of joints so as to reduce the force of shocks caused by the passage of wheels. The maximum axle load for English railways is given as about 20 tons.

As to the design of joints, however, it was pointed out that the joint should be simple, composed of few parts, easily installed and economical in maintenance. Three types were recommended for extensive trial: (1) bridged joints, in which the ends of the two rails rest upon a metal bridge supported by the two joint ties; (2) suspended joints having the joint ties closely spaced; (3) joints which do not require holes in the web of the rail.

Joints of this last type are in use on French railways, the rail base and web being gripped by clamps tightened by horizontal wedges. Attention was called to the value of joints of this type as tending to eliminate a considerable proportion of the most frequent form of rail breakage. A British report stated that there is little evidence that bolt holes, if properly made, are an active cause in initiating breakages. This statement was weakened by the admission that most rail



ENGLISH FLEXIBLE RAIL JOINT

breakages occur near the joints. From this it appears evident that bolt holes are likely to be an important secondary or contributive cause. A low record of rail breakages on the New York Central R.R. was attributed to the use of the three-tie type of suspended joint with long six-bolt splices.

Numerous varieties of joints, standard and experimental, were reviewed in the several reports, indicating widespread attempts to improve upon the ordinary splice joint, but apparently without much success. Splice bars of Z-section, with a lower web depending below the rail, are used to a limited extent. Suspended joints are generally favored, but in England several forms of supported joints are reported in trial use. Most of the latter, however, are really of the bridged type; they are said to be satisfactory, except as to their extra cost due to the heavy bridge plates or base supports. In a bridged joint on the Bengal-Nagpur Ry., of India, having splice bars shaped to support the rail base, a curious feature is the placing of the bolt holes near the top of the rail web, In a special construction employed on the Alsace-Lorraine Rys., of France, two pieces of rail 8 ft. long are cranked so as to pass under the two joint ties and rest on metal plates on the four shoulder ties. The track rails have ordinary fish-type splices.

Hinged or flexible joints are included in the experimental types. Several English railways have laid short stretches of track with the Joyce joint, shown in the accompanying drawing. This joint is made with short four-bolt splice bars in which the contact surfaces are only about 3½ in. long under the head and 4½ in. on the rail base. Beyond these bearing surfaces the bars are tapered so as to be clear of the rails. The design appears to be practically identical with the Roach reinforced rail-joint tried on the St. Louis Southwestern Ry. and described in *Engineering News-Record* of Oct. 2, 1924, p. 537. In the Roach joint, the flat splice bars are 17½ in. long, but with only 4 in. of contact on the head and base of rails, while the ends of the bars are sprung inward by the bolts so as to be in contact with the rail web. A curious form of hinged joint which has been used for many years in India has

five bolts, with the middle bolt passing through notches in the ends of the rail webs.

As to breakages of splice bars, English experience indicates that these are infrequent where there is a high standard of track maintenance. On two important railways, such breakages averaged four and six per mile of main track per year. But on a Scotch line they run as high as 18 per mile per year, owing to loosely tamped ties and the effects of frost. The reconditioning of splice bars is not practiced to any extent in Europe, but it is stated the Canadian National Rys. planes worn bars to fit lighter rail sections and also inserts metal strips between the worn contact surfaces of bars and rail heads. These strips are tapered, with the greatest thickness at the middle. Similar devices have been used on French railways.

Other conclusions of the International Railway Congress in regard to rail joints, supplementing those already noted, included the following: (1) Means for stopping the creeping of rails should be provided independently of the joints; (2) periodical lubrication of the splice bars is advisable, the bars being removed to facilitate inspection of the ends of the rails; (3) heat treatment of splice bars is advisable, to eliminate any abnormal brittleness of the metal; (4) the shaping of old splice bars by heating and re-forging is advisable for the sake of economy.

As to failures of splice bars, an examination of a number of broken bars from a railway in India showed that nearly all had cracked from the top, according to a recent writer in *The Engineer*, London. In each case the crack was at the middle of the bar and ended near the neutral axis which, the writer states, clearly indicate negative bending stresses, where tension is produced in the top flange. With tensile or shear stresses as the cause of failure, fracture would generally have been complete. These were all 26-in. bars with four bolt holes 6 in. c. to c.; some had only a small bottom flange, while others had a big flange.

It has been assumed in general that the maximum bending stresses in splice bars would be imposed with a load directly over the joint, causing tension in the bottom edge, but experience shows that failures in both plain and angle splice bars nearly always start from the top, which must therefore, have been in tension. The reason given is that the depression curves of wave motion of the track as a whole are greater than the depression of a rail between adjacent ties. The writer points out that some of the track depression curves in the 1918 report of the American Joint Committee on Stresses in Railroad Track show that the spacing of the wheels is often of greater importance than the actual axle load. Between two wheels 5 ft. apart, the depression curves may be comparatively flat, with low bending moments in the rail. But with wheels 9 ft. apart, the curvature producing a negative bending moment over a length equal to that of the splice bars may be greater than the reverse curvature over the same length immediately under one wheel.

The tendency of modern design to shorten the splices is noted in the article, which gives the standard British length as 18 in. and approves of the Joyce joint, mentioned above, since its 18-in. bars are only in contact with the fishing surfaces for a length of 7 in. The writer goes so far as to say that only two bolts are needed for rigidity, so that there should be little necessity for bars of a greater length than 7 or 8 in.

As to the question of supported and suspended joints, the writer of the article considers that the former would give smoother riding track and reduce the intensity of the pressure between rail and splice bars when the joint is immediately under the load, especially if some form of bearing plate is used. He makes no mention of the bridged type of joint so widely used on American railways, in which the rail joint is between the two joint ties but is carried by a bridge plate resting on these ties.

Los Angeles Raises Water Rates for Domestic Use and Irrigation

LAST fall the Los Angeles board of water and power commissioners decided upon an increase in the schedule of water meter rates based on recommendations made by William Mulholland, chief engineer of the municipal water bureau. Mr. Mulholland characterized the rate of 10c. per 100 cu.ft. then in effect as "exceedingly and unusually low" and to support this claim submitted figures showing an average maximum rate of 18c. per 100 cu.ft. for 183 of the largest and most representative American cities. He directed attention to the fact that within two years the city has spent approximately $8,000,000 for Owens Valley lands to protect the water supply and that these and other expenditures had not increased the earnings of the water bureau which are expected to meet interest and sinking fund charges on all outstanding water bonds —about $2,500,000 for 1926.

In accordance with Mr. Mulholland's recommendation the following new schedule per 100 ft. consumed in a month was adopted: For the first 10,000 cu.ft., 13c.; for the next 40,000 ft., 11c.; for the next 50,000 ft., 9c.; for all in excess of 100,000 ft., 7c., provided that the minimum monthly rates shall not fall below the following: For ⅝-, ¾- and 1-in. meters, $1; 1½-in., $1.50; 2-in., $2; 3-in., $3; 4-in., $4; 6-in., $6.

With regard to water used for irrigation, which is extensive, particularly in the San Fernando Valley, the new schedule states:

> The rates to be charged for water for combined irrigation and domestic use, through the same meter, under constant pressure, and at the will of the consumer, upon tracts or parcels of land under single occupancy, aggregating not less than one acre where water is used on ground planted to trees and crops grown for commercial purposes, shall be 5c. per 100 cu.ft., and in addition thereto a monthly service charge of $1 for 1-in. and $1.50 for 1½-in. and 2-in. meters.
>
> For water used intermittently for irrigation, for limited periods, and under the control of the local water overseer, the charge shall be 1.8c. per 100 cu.ft., with a minimum charge of $3 for each time the water is turned on. The water for such intermittent use shall be delivered at the convenience of the department and subject to the demands of commercial and domestic consumers and to rotation of service among intermittent users, and arrangements for such service must be made and the water desired paid for in advance, provided that the rate prescribed in this section shall only apply to water furnished by gravity.

Besides the meter rates, the new schedule includes an extensive series of flat rates for unmetered water used for domestic and other purposes, with a minimum monthly charge of $1. The department reserves the right to install a meter or any unmetered service whenever it sees fit and grants unmetered consumers the right to have meters installed, the latter at their expense.

Partial Evaporation of Trade Waste Eliminates Taste in Water

Source of Contamination of Water Supply of Escanaba, Mich., with Creosote Wastes Traced on the Ice to Chemical Works

OBJECTIONABLE tastes in the water supply of Escanaba, Mich., due to trade wastes, have practically been eliminated by the partial evaporation of a small portion of the wastes discharged from a chemical works. Discovery of the cause of the trouble, which has been bothersome for a number for years, was made by R. L. McNamee, engineer for Hoad, Decker, Shoecraft & Drury, consulting engineers. He made his report and recommendations two years ago but its release by Fred R. Harris, city manager, together with the latter's statement of the success of the procedure through co-operation with the Delta Chemical & Iron Co., has only recently been obtained.

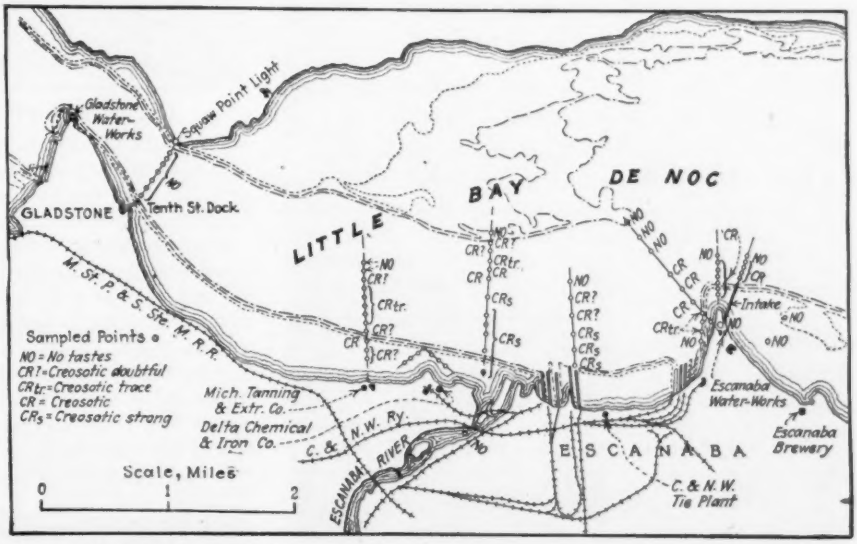
Little Bay de Noc, the source of the municipal water supply of Escanaba, is the smaller of two bays, northerly fingers of Green Bay, an arm of Lake Michigan. Little Bay de Noc is about 18 miles long and 4 miles in average width. Its hydrography is peculiar by reason of its deep and narrow channel, between wide shoals on either side, and is suggestive of a river which has overflowed its banks. Above Escanaba the channel is little more than a mile wide and ranges from 20 ft. deep at its upper end to more than 80 ft. deep opposite the Escanaba Lighthouse. That part of Little Bay de Noc above Escanaba receives drainage from a large part of Delta and Marquette Counties and smaller parts of Dickinson and Alger Counties, an area aggregating about 1,554 sq. miles.

This great natural waterway, with its deep channel and sheltered harbors, has favored and encouraged a vigorous industrial development along the shores of the bay, mostly allied with the lumber industry. Among these plants was the chemical works, 3½ miles north of Escanaba, discharging a considerable volume of waste from distillation of wood into a lagoon which overflowed into the bay.

Early in the investigation of the water supply, which is taken from the bay 2,600 ft. from shore through a submerged crib at a depth of 65 ft., chlorine and algæ were eliminated as the causes. A systematic survey in winter through the ice started in the vicinity of the intake and progressed up the bay guided by the observed tastes in the samples. Holes were 300 ft. apart. When the creosotic taste disappeared another series was started. Thus the most serious trouble was traced to the west bank and the chemical plant.

For the purpose of these studies, an arbitrary measure of the intensity of the taste-producing constituents of the several wastes, termed the "taste index," was used. It is the greatest number of thousands of parts of tasteless water in which one part of the sample may be diluted and still leave a perceptible taste of the original. Mr. McNamee examined in detail the wastes from the various processes and concluded that a Myers still was responsible for 96 per cent of the contamination whereas its volume was only 1 per cent of the total waste of the plant. Miscellaneous cooling waters were 22 per cent responsible though contributing more than 98 per cent of the volume.

It was concluded that the occurrence of tastes in the winter was not a coincidence but due to the fact that the ice acts as a wind break for the water surface and thus reduces the distribution and dilution of the contamination by wind and wave action. Spring floods aided in diluting the wastes and flushing out the bay. Wind-driven water from Green Bay was also considered a dilution factor during the open season.



EXTENT OF CREOSOTIC TASTES IN LITTLE BAY DE NOC, AT ESCANABA
Determined by samples taken through ice in winter

The Myers apparatus is a tall copper still about 65 ft. high. It separates the crude alcohol at about 91 per cent test and yields two grades of hardwood oil and an acetate of lime solution. The dump from this apparatus is practically continuous at a rate of 2,500 gal. per day. The heavy, oily, tarry fluid is passed through a tar settling tank in which it is diluted so that the effluent of the settling tank amounts to about 25,000 g.d. This effluent is dark brown in color and carries a murky, tarry sediment in suspension and floating globules of light iridescent oils. It has a slightly sweet, strong tarry odor. When diluted in tasteless water in the proportion of 1:300,000, a creosotic taste is still perceptible.

A series of experiments developed the fact that the taste-producing constituents in this dump were exceedingly volatile. The evaporation of about 10 per cent of the volume of this waste reduced its intensity by about 96 per cent. On the basis of 96 per cent responsibility for this waste, the corresponding reduction of the total plant waste effluent would be about 92 per cent. Thus it appears that if a volume equal to about 0.1 per cent of the total waste effluent be evaporated, about 92 per cent of the taste-producing constituents are eliminated.

Early in January, Mr. Harris stated that the source

of the contamination had practically been eliminated by the partial evaporation of the individual process and the use of live steam in the waste liquor tanks. As for years such wastes from this plant and others have been dumped into the bay so that the bottom is covered 6 to 24 in. deep with a tarry or creosote layer, Mr. Harris feels that it will take years to eliminate occasional tastes caused by unusual winds stirring up this layer.

Co-operation of the chemical company in this case was obtained from the start. Efforts toward elimination included a lagooning of the waste in a pond of several acres extent where the warm liquid could stand for several days uncovered by the ice. This was not successful. Changes in the exhausting column effected only partial elimination. Another method was tried of eliminating the exhausting column. Partial evaporation seemed finally the most satisfactory procedure.

New Hydraulic Laboratory for Worcester Polytechnic

Small Laboratory Built in 1894 Replaced by Much Larger One—Provisions Made for Many Kinds of Tests

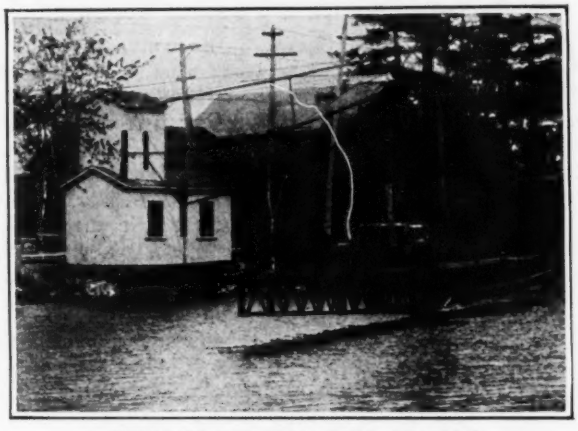
WORCESTER Polytechnic Institute recently opened the greatly enlarged Alden hydraulic laboratory situated in the village of Chaffins, Mass., five miles north of the Institute. The hydraulic facilities of Worcester Polytechnic are unique, in that they not only include

EXTERIOR OF ALDEN LABORATORY

now two laboratory buildings with considerable up-to-date equipment, but also flowage rights on a nearby stream with three ponds for controlling the flow through a fall of some magnitude.

The site of the Alden laboratory, that of an abandoned woolen mill, was discovered in 1894 by Prof. G. I. Alden, of the Mechanical Engineering Department of the institute, and was purchased and presented to the institute by Stephen Salisbury, president of the board of trustees. The first laboratory was built here in 1894. In 1910, through the generosity of Professor Alden, a low-head laboratory was built on the site of an old grist mill across the road from the main laboratory. In 1924 Mr. Alden, now a member of the board of trustees, gave additional money for the enlargement of the original laboratory. This is the structure which was opened recently. The building is of wooden mill-type construction, 110 ft. long by 45 ft. wide, and 15 ft. high with two towers running up above pond level, the main tower for head measurements and for the surge tank. The other buildings making up the group consist of the old low-head laboratory, a wooden building 70 ft. by 36 ft., an office and a storehouse.

Hydraulic Equipment—The equipment of the laboratories includes 400 ft. of 40-in. pipe from pond 2 to the

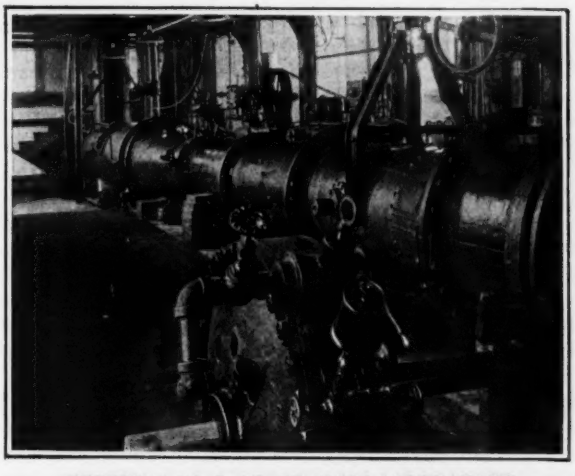


CURRENT METER RATING STATION

main laboratory for experiment in determining the friction of flow and measurement of flow. It was upon this pipe line that the first experiments with the salt velocity method of measuring flow were made.

A differential surge tank of the Johnson type is located on the main pipe line just inside the laboratory. Beyond this is a 36-in. Venturi meter followed by a Dow valve and two water wheels, an 18-in. Hercules and a 15-in. Platt. Both of these are arranged so that they can be tested for power and efficiency by use of the Alden absorption dynamometer. From this point water passes to a 10-ft. standard weir, situated at the farther end of the weir flume in the basement.

A 12-in. and a 6-in. pipe line branch off from the main



INTERIOR OF PART OF MAIN LABORATORY

line just above the large Venturi meter, the 12-in. line supplying water to a 12-in. Venturi meter which discharges into a wasteway over the standard weir or into a 50,000-lb. weighing tank, and the 6-in. line runs to an experimental tank and a weighing tank and also supplies water to 15x6-ft. tank recently built for testing models of penstock intakes. Both laboratory buildings are supplied by a 6-in. town water pipe under a pressure of 135 lb. per sq.in.

A concrete dam and weirs in the wasteway in front of the main laboratory control and measure the flow and a concrete flume along the side carries water to a distributing forebay. An overshot waterwheel is supplied from this forebay and there is an opening left on one side for future extension. The overshot wheel can be tested for capacity and efficiency by means of a Prony brake located within the basement of the main laboratory and a weir at the end of the concrete flume. The flume is arranged for current meter and salt velocity measurements.

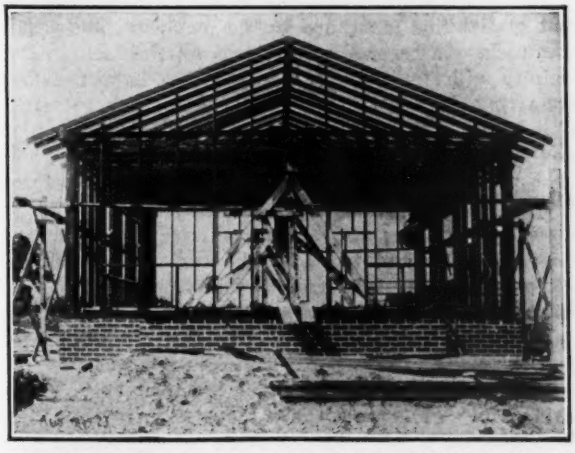
In the low-head laboratory there is a copper-lined pressure wheel case where model waterwheels and draft tubes can be tested.

Meter Rating—The current meter and pitot to rating stations, located on a large rock in one of the ponds, is operated by means of waterwheel gear and rope drive. The boom is arranged to describe a circle 84 ft. in diameter. It is mounted on ball bearings and the ends can be turned up to any speed up to 20 ft. per second.

One of the chief assets of the laboratory is the complete control of the water from the storage reservoir down to the district limits of the Boston Metropolitan Water District. The flow can be stopped entirely for repairs or new construction or can be increased up to the maximum flow without damage to anyone on the river below as the water eventually flows into the Wachusett reservoir.

Steel-Frame Cottages Constructed by Toledo Builder

STEEL framing for dwelling-house construction has been taken up by a Toledo building firm, C. H. Dexheimer & Son, which has built a number of garages and cottages; one of them is illustrated here. Experience in their construction shows, according to Mr. Dexheimer, that under material and labor prices at Toledo the steel-frame fireproof house is of practically the same



STEEL FRAME ONE-STORY COTTAGE BUILT AT TOLEDO

cost as a wood-frame house. Low depreciation and increased insurance against fire are also pointed out as advantages, together with absence of shrinkage, protection against mice and other vermin, speed of erection, and low cost of maintenance.

The views show the steel frame and finished cottage. The frame is built of metal-lumber floor joists, 4-in. pressed channel studs for walls, and rib lath for plastering base and for floor reinforcement. The floor joists are I-joists, 5 in. deep, spaced according to the load requirements; they are bridged with 14-gage wires, crossed and twisted to tighten. Studs are spaced about 24 in. on centers, and for the exterior walls are covered with rib lath weighing 3½ lb. per square yard, which is plastered on the outside with waterproofed cement to a thickness of about 2 in. and back plastered. The floors are 2 in. of concrete on 4-lb. rib lath, covered with finished oak floor nailed to wood sleepers attached to the steel joists. The ceiling is carried by 4-in. channel joists, and the roof is framed with 4-in. channel rafters butted into a ridge strut of two 5-in. channels. In the structure shown, the basement ceiling is not plastered.

COMPLETED COTTAGE, STUCCO WALL SURFACES
Asphalt shingles on wood sheathing; steel sash; size of house, 24x34 ft.; approximate cost, $4,000, including plumbing, heating and electrical work, fireplace and hardwood floors and trim.

If a plastered basement ceiling is put in (on metal lath), the concrete floor may be omitted and the wood floor laid directly on sleepers on the joists; the two forms of construction should give about equal protection.

Based on small-quantity purchasing, the cost of this house, 24 ft. 4 in. x 34 ft. 4 in., is $4,000 to $4,200. Working on a larger scale should reduce the cost.

New State Maps Showing Public Land Surveys

A new map of the State of Montana showing completely its present public land survey system has been issued by the General Land Office of the Interior Department. The last map of the state was published by the General Land Office in 1917. During the nine years since then there have been large extensions of the rectangular system of public land surveys, which are shown on the new map as well as the county and reservation boundaries, railroad lines and general items of topography, corrected where necessary and brought to date. The names of cities and towns have been carefully verified and any necessary corrections have been made. Copies of the map of Montana and other public land states are available to the public through the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 25 cents each, with the exception of the map of California which is printed in two sheets and is sold for 50 cents.

Occurrence and Prevention of Small Wastes in Construction

Direct Wastes of Materials and Supplies and Time Losses Because of Poor Direction, And Some Practicable Ways of Reducing Them

By W. N. Jones
Superintendent, Gauger-Korsmo Construction Co., Tampa, Fla.

THE most unmanageable of all wastes in construction are the little ones. Each is so small individually that men and managers pass it by as insignificant. The accumulation, however, is significant. Prevention, therefore, becomes an important task of construction superintendence. It cannot be made complete and inclusive under the best conditions and management but it can be carried further than it usually is. Virtually all the usual wastes are preventable as their enumeration and the statement of remedies which follow will disclose.

Labor Time Losses

Time waste is pronounced on all construction operations. With the best of laborers, labor-time loss is seldom less than 20 per cent. Generally it is more and always it can be reduced by vigilance in direction. The common time losses are as follows:

Slow Starting—Slowness of the men in checking out in the morning and in setting to work, and tardiness in starting work at the end of the noon hour can be completely stopped by blowing a five-minute whistle and docking any man not in his place at work when the second whistle blows.

Checking Out Tools—Time wasted by men getting out tools in the morning and during the day and checking them in at night can be kept at a minimum if each foreman will have close to his work a tool box containing the tools he generally uses. He can then check out ordinary tools direct from the box, thus avoiding crowding at the toolroom and allowing more attention to be given the men that must have special tools. It also increases the speed of getting started.

Lack of Material or Too Much Material—If there is a shortage of lumber, the men waste time in looking for what they want. If there is too little sand or gravel, they spend time raking and scraping it up or in transporting it from too great a distance. If too much material is piled around, other material must be moved around or over it, or it must be progressively moved ahead to make room for incoming stuff. The men get careless and use new material where old or partly used would answer the purpose. Too much material, especially when shipped by rail, piles up demurrage or disrupts the force by the necessity of using all available means to unload and dispose of the accumulation.

Too Large or Too Small a Crew—If too large, one man is constantly in the way of the other or one is waiting for the other to do a certain task which each knows is only sufficient to take the strength of one or each is doing only a part of what he is capable of doing. When the crew is too small the men will not put forth their maximum efforts. An unbalanced crew makes one end work too much or the other end work too little. No man, however ignorant, will work to the best advantage if he believes he is doing his share while someone else is getting off easy.

Men Unfitted—In many cases men are misplaced, that is, they are put at duties for which they are unfitted. Because a man is good with a shovel is no sign that he is equally good on a wheelbarrow. Each man's ability should be studied and the work for which he is best fitted given him.

Poor Lighting—The time lost from poor lighting is generally confined to night work. Some of this is due to men deliberately sneaking off and can be partially overcome by a wide-awake foreman, but no man can be expected to move fast and accomplish the maximum amount of work if he has to watch his step at every move he makes. Even with the best of illumination, on outside work shadows are cast and a man will necessarily have to use more care to prevent injury to himself or others than in daylight.

A 40,000 FT. B.M. PILE OF WASTE LUMBER
It was estimated that about a quarter of this waste was due to careless carpenters.

Accidents—Accidents increase the turnover and the cost of liability insurance to the employer, and delay the work. In case of an accident all the men in the vicinity will stop work to see what has happened and some time is lost in getting the crew back to work. If it is necessary to continue the work where the man was injured the entire crew will be over cautious for some time and will not move along as fast as before. Accidents can be prevented to a great extent by having a safety committee and by frequent inspection of machinery, cables and tools, by the careful building of scaffolding, by safety guards on shafting gears and machinery, by covering over all openings or by placing rails around them, by never overloading anything in a wrong place and many other simple precautions.

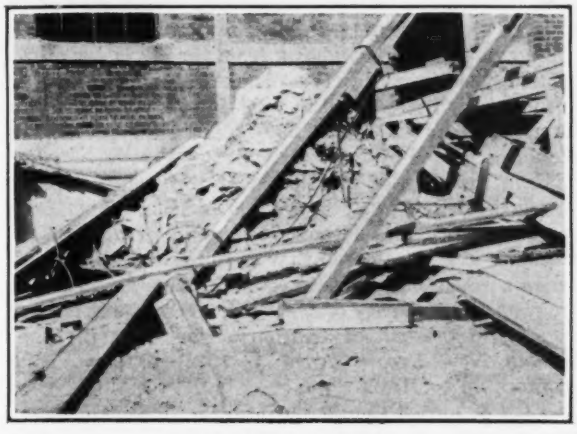
Interference—Time losses from interference can be divided into (1) those where there is more than one contractor on a job, and (2) those arising within the organization itself. The only way to reduce interference in the first case is for each contractor to give and take. It can be avoided almost entirely in the second case by each foreman doing his best to keep his gang and material in their proper places and out of the way of other crews. It is always best to allow a man to do things in his own way as far as it is practicable.

His ways are the ones that he is familiar with and any great change in them will slow up his work until such a time as he has become familiar with the new way. In the case of men running machines it is better to tell them just what is wanted and then let them work things out for themselves. The constant advice and presence of a superior only make the man nervous and leads him to doubt and lose confidence in his own ability.

Visiting and Talking—Visiting and talking are of every day occurrence and probably waste more time than any other single thing except laziness. The only thing that can be done is for the foreman to set the example and restrict conversation as much as possible.

Smoking — If cigarettes are prohibited, the time wasted by other forms of smoking is probably balanced by the fact that most men work better if they can smoke occasionally. It gives them a chance, once in a while, to straighten up and get the kinks out of their backs and adds somewhat to their sense of satisfaction. Cigarettes should be prohibited, because of the danger of fire and because a cigarette smoker will smoke more often than others.

Surveying Instruments in the Way—Sometimes it is necessary to set instruments for lines and grades on that part of the job that is being worked upon. Instruments are very easily knocked over and damaged. Time is wasted because the men have to go around them and be constantly careful not to hit them when working nearby. By care on the instrumentman's part this waste can be almost entirely eliminated by setting the instruments out of the way of the men.



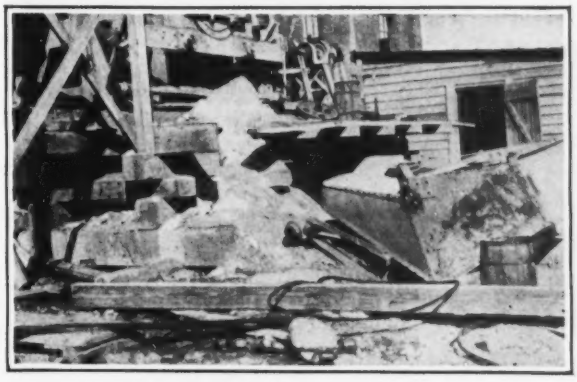
WASTED CONCRETE

About 20 cu.yd. were wasted in a run of 2,500 cu.yd. by mixing too much to fill forms and by a leaky receiving hopper.

Wastes of Materials and Supplies

Actual loss, waste by carelessness or extravagance and destruction by careless use all contribute to waste of materials and supplies. Here as in time losses workmen's wastes are considered primarily. The common wastes are:

Iron, Nails, Clamps, Bolts, Nuts and Washers—Small pieces of iron, nails, clamps and other like materials are constantly wasted by all users simply because they are small in value, small in size and easily dropped and lost. When a man drops a nail, he is not supposed to stop work and pick it up, but he can certainly be more careful. He need not take more nails or clamps out of the stock room than he expects to use and then leave the surplus on the ground. If a quantity of nails or clamps is needed, provide a small keg or box for them and return the surplus to the stock room at night. Another practice is to dump out the few nails, which are left in the keg in order to secure the use of the keg. Small pieces of iron when cut off should be carefully placed in some container and returned for storing and stock instead of being carelessly thrown on the ground and covered up. Any kind of iron will come in useful and, if too badly bent or cut up, can always be sold for junk.



WASTED SAND AND CEMENT

It was estimated that about 4 cu.yd. of these materials were wasted in a run of 118 cu.yd. by the mixer runner being careless in dumping the skip.

Cable, Ropes and Chains—Cable, ropes and chains are constantly wasted and ruined by lack of care and by misuse. No one can prevent a cable from cutting itself out over an improperly designed or too small a sheave but every man can prolong its life by seeing that it is properly greased with a good compound and kept out of the mud and sand, properly wound on a drum of adequate size, kept from slacking and jumping into the gears or sheaves and wound so as not to kink. Ropes should be kept dry and clean and free from grease and oil. They should be carefully uncoiled when new and stretched. They should be coiled up always in a clockwise direction and then hung on pegs in a dry place. In case a rope gets wet it should be dried at the earliest possible time, preferable before coiling. Chains should be kept clean and dry and immediately on completion of their work they should be returned to the toolhouse.

Lumber—Lumber, constituting as it does one of the major materials that go into a construction job, lends itself to an enormous waste, unless the very greatest care is exercised in selecting the pieces and only using the saw when *absolutely* necessary. Most workers in lumber have been dubbed wood-butchers and with very good reason. Instead of selecting small pieces of lumber, which are just as well suited for the particular piece of work at hand, they seize the nearest piece of new material that they can reach and ruin it for future use by cutting it into small pieces. Many times a great number of large nails are driven into a piece of material when half as many of a smaller size would do as well. In wrecking forms and scaffolding many times the joists, stringers and lagging are allowed to fall on hard surfaces from great heights, shattering the boards and breaking the small timbers. A little care would largely eliminate this waste. Another source of waste of lumber is scattering it around, and allowing it to be driven over by teams, tractors and engines or covered up by

earth fills, drippings from concrete mixers or caving banks. The latter sources of wastes and some of the former can be greatly reduced by placing some one in charge of the lumber who will see that it is kept cleaned, properly sorted, graded and stacked in neat piles.

Gasoline, Oil, Fuel and Greases—Gasoline, oils, fuels and greases play a minor part in any large construction job, but nevertheless at the end of the work their cost will have run up into a tidy sum. Oils and greases should be kept in tightly covered containers to prevent dust, grit and other foreign substances from getting into them. Gasoline and kerosene containers should always be kept as clean as possible, and well stoppered. In no case should gasoline or kerosene be put in old paint cans for one filling spoiled will more than pay for a new container. Care should also be exercised not to spill gasoline, because of the fire hazard.

Cement and Concrete—As cement is the most important and costly ingredient that enters into concrete construction the prevention of its waste is of prime importance. Mixed concrete follows closely. Weatherproof sheds for cement should always be provided with a free access of air from below the floors. If possible cement should be stored so that the first to be received will be the first to be used. In case the job is not of sufficient size to justify the proper sheds, then it is advisable to stack the cement on platforms slightly raised above the ground and to cover the piles with tarpaulins supported on boards. A great amount of cement is destroyed each year by lack of a little care in covering it properly at the end of a day's run.

A great saving can be effected in concrete by keeping the handling equipment, barrows, buggies and chutes, tight; by occasionally cleaning up in and about the mixer while operating; by utilizing large enough mixers; by tight forms and by being very careful not to mix any more than just enough to fill the forms properly. Clean runways, clean grounds and clean machinery at all hours of the day more than pay for the extra cost of the labor to keep them clean.

Tools and Machinery—The first requisite in cutting the waste of tools and machinery is some system whereby a check on them can be kept thereby making each man responsible for the tool or equipment that he is using. This prevents loss by theft and carelessness. More especially is this true when a man is made to pay full value for a loss when the loss is due to his negligence. A perfectly good tool or machine can be ruined by improper use and failure to report to the proper authority when equipment is in bad shape.

A few examples of misuse are as follows: A monkey wrench should never be used for a hammer. A drill should never be used for a crow bar. Shafting should never be used as pries. Pliers should never be used as wrenches. Light water buckets should never be used for concrete pails. In case of machinery, oils should never be used for greases or greases for oils. Machines should very seldom be overloaded. All machines should be kept lined up and tight. Machines should not run hot or without lubrication. Poor grades of oil should never be used. High speeds beyond the factory rate should be avoided. Machinery and tools should be kept clean. A few simple rules based upon the above don'ts with a few more added would do away with 90 per cent of the waste of tools and machinery.

Valves, Pipe Fittings, Tarpaulins and Miscellany—The waste of valves, pipes and accessories can always be attributed to carelessness. However, there is one source of waste which occurs in cold climates especially in the case of pipes, valves, fittings, tarpaulins and the like; that is freezing water. A pipe containing water, if allowed to freeze solid, will surely burst. A tarpaulin will many times become torn and rendered useless when an attempt is made to remove it or to clear away ice. Tarpaulins are often ruined by allowing cement, concrete or concrete water to get on them in any quantity. Care must also be exercised to keep tarpaulins away from fires and sparks. Many structures under construction have been badly damaged by tarpaulins first catching fire and then setting fire to the falsework.

Progress and Methods on the New Cascade Tunnel: G. N. Ry.

SATISFACTORY progress has continued on the new 7¾-mile Cascade Tunnel of the Great Northern Ry., and up to the end of the first six months of work, on May 31, 1926, the total penetration was 2,061, ft. at the east end and 3,348 ft. at the west end, a total of 5,409 ft. This record is 2,441 ft. and 145 days ahead of the schedule as programed in advance by the contractors. On the other hand, the Mill Creek shaft has been delayed, by water, pumped out at the rate of 75 to 100 gal. per minute, so that it was 48 ft. and 14 days behind its schedule. Judging from the character of the ground penetrated by the pioneer tunnel, the heavy ground encountered in the west heading of the main tunnel will end at about 1,000 ft. from the portal, and should be passed by July 22.

Since the time of completion of the tunnel depends largely upon the progress in this pioneer tunnel from the west end, which is now 70 days in advance of the schedule, it is considered that the progress of the tunnel as a whole may be said to be 70 days ahead of the program. A summary of the work during the first three months, to the end of February, was given in *Engineering News-Record* April 1, 1926, p. 539. Total progress up to May 31 was:

West End: (Scenic)	Ft.
Pioneer tunnel	1,204
Incline	1,327
Top center heading	515
Full tunnel heading	380
Center heading	56
Cross-cut 1	80
Cross-cut 2	72
East End: (Berne)	
Center heading	2,091
Full heading	30
Shaft (Mill Creek)	368

It may be explained that from the west end a pioneer tunnel is being driven parallel with and in advance of the main tunnel; but to avoid delay in passing through soft ground near the portal, the pioneer tunnel is also attacked through an inclined drift on the east side of the North Fork of the Tye River. From the east end, only the main tunnel is being driven, with a center heading which will eventually be followed by enlargement to a full tunnel section. At 2¼ miles from the east end, a shaft is being sunk on the line of the main tunnel, from which headings will be driven in both directions. The scheduled date for holing through is Oct. 30, 1928.

Power Equipment—During the quarter ending may 31, the work in general consisted in finishing camp and work buildings, continuing the clearing of land, designing and installing water and sewer systems, installing permanent machinery and organizing the tunneling

and shaft sinking operations on a permanent basis. On the west side, at Scenic, there are now four Diesel engines, one of 120 hp. and three of 360 hp., with four motor-driven compressors giving a capacity of 3,800 cu.ft. per minute. On the east side, at Berne, the transmission line has been connected to the plant and current is operating three motor-driven compressors with a total capacity of 2,850 cu.ft. per minute. At the intermediate shaft, the same current serves a similar compressor plant and the pumps, but there is also a stand-by plant of two 360-hp. Diesel engines to operate the pumps in case of failure of electric power.

Character of Ground—On March 9, the pioneer tunnel from the west end struck a soft formation of the consistency of sloppy concrete, necessitating solid timbering and calking the cracks between sets with excelsior. This condition continued for about 140 ft., when solid granite was again encountered on May 2. The first cross-cut to the main tunnel, at 1,000 ft. from the pioneer portal, is also in good granite. The full heading for the main tunnel was still in soft ground and arch segments were placed 2 ft. c. to c., which condition was expected to continue for about 200 ft. In the top center heading for the full heading, the material was soft but comparatively dry. In the pioneer incline approach on the east side of the Tye River, the work was in coarse gray granite, good for drilling and breaking. However, it was wet and the effect of water was to make the fine material produced by blasting set like concrete, thus making the track work difficult.

The shaft continued in sound, hard dark granite, shot with quartz, with much less water than had been encountered above. In the center heading, at the east end, the gray granite has changed to short grained granite, which is exceptionally good for drilling and breaking.

Tunneling Plant—At the west end there are 20 drifting drills and two stoping drills, with a drill carriage on which four drills are mounted. Two power mucking shovels load dump cars of 50 cu.ft. capacity, which are handled by six 6-ton trolley electric locomotives, except that in the full heading of the main tunnel trunnion-type cars of 27 cu.ft. capacity are used. A 60-hp. gasoline hoist hauls cars on the temporary incline drift to the pioneer tunnel. In the pioneer heading, a portable crossover transfers empty cars to the loading track, while an air-operated transfer hoist is used for this purpose at the incline. At the east end, all drilling is done with drifter drills mounted on a horizontal bar. Cars of 50 cu.ft. capacity are loaded by a power mucking shovel and are handled by two 6-ton trolley locomotives. At the shaft, sinker drills are used and the muck is hauled away in small 27-ft. cars.

The contractors are A. Guthrie & Co., Inc., St. Paul, Minn., whose forces on May 31 included 429 men at Scenic, 181 at the Mill Creek shaft and 165 at Berne. Of the total of 733 men about 50.5 per cent were working in the tunnel. R. F. Hoffmark is general superintendent for the contractor; W. E. Conroy, assistant general superintendent, with O. C. Hartman, C. G. Jones and Frank J. Kane as superintendents at the Scenic, Berne and Mill Creek camps respectively. The work is under the direction of J. R. W. Davis, chief engineer of the Great Northern Ry., and Colonel F. Mears, assistant chief engineer, with M. J. C. Andrews as engineer in charge on the work.

Engineering Museum for Miami Conservancy District

By C. S. Bennett
Engineer, Miami Conservancy District, Dayton, Ohio

A PERMANENT exhibit of the engineering work of the Miami Conservancy District has been set up in the headquarters office building at Dayton, Ohio. Here, in specially designed cases, and tables, are displayed photographs, boring samples, core samples and several interesting specimens unearthed during the progress of the excavation at various points in the Miami Valley, and a large relief map of the District.

The relief map is about 12 ft. long by 6 ft. wide and covers 1,275 square miles. It is modeled to a horizontal scale of 1 in. equals ½ mile. The vertical scale is approximately 1 in. equals 528 ft. The dams and levees built by the district are shown to a slightly exaggerated scale in order that they may be readily picked out. Timbered areas are shown as patches of green plush, buildings by small red and white cubes glued to the surface. The background of the map is painted green, roads are outlined in brown and streams in silver. The areas behind the retarding dams which would be covered by backwater under maximum flooding conditions are painted dark green. The map is mounted on a table having plate glass sides and top.

EXHIBIT OF PICTURES AND CORE SAMPLES OF DAMS

Some 150 photographs are displayed in vertical cases, and illustrate both construction and completed structures. These pictures were selected from the 4,000 which were made during progress of the construction work. Samples of rock core borings and wash borings are displayed in other cases, the cores on glass covered tables and the wash borings in small glass jars in cabinets. Several samples of the core material from the hydraulic fill dams show the homogeneity and fineness of the cores, entirely unstratified.

Trusses Carry Office Building Over St. Louis Theater

Eleven Stories Carried at Sixth Floor Level on Steel Trusses of 126-ft. and 117½-ft. Span—Tall Unbraced Columns—Long Cantilever Girders for Theater Balcony

IN A 17-story steel-frame building having a theater occupying the greater part of the site and surmounted by an 11-story superstructure for office purposes, a large amount of special construction is required to avoid columns in the theater space and to support the superstructure over that space. The problem of such a combination was presented to the structural engineers of the Ambassador Theater Building, St. Louis, Mo., and, as in most cases of this kind, the structural design was governed or limited to a considerable extent by the architectural design. Views of the structure during erection are shown in Figs. 1 and 4, while Fig. 2 shows typical sections.

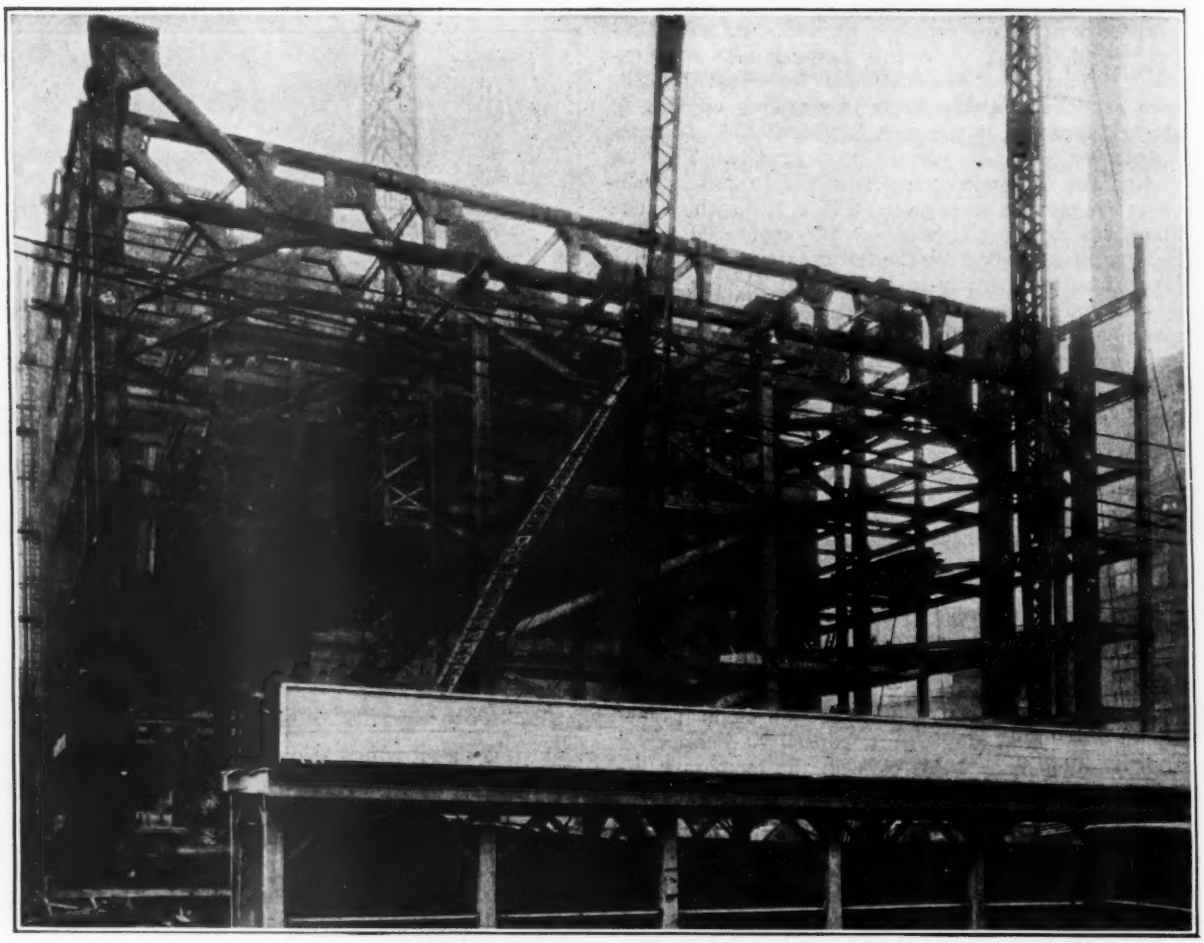


FIG. 1—TRUSSES TO CARRY 11-STORY SUPERSTRUCTURE

Truss Framing—Steel trusses of 126 and 117½-ft. span and two stories deep were adopted to carry the upper eleven stories over the theater area. In plan, the building is about 130x164 ft., with the theater occupying the greater part of the area for the lower portion, but above the seventh floor it is L-shaped, with wings 60 ft. wide laid out for general office purposes. Both these wings extend over a part of the theater.

As shown by the framing plan, Fig. 3, six trusses extend across the narrower dimension of the building. These have their bottom chords below the sixth floor level, with the theater ceiling suspended from them, while the top chords are below the eighth floor level. The first truss, spanning the entire width of the building, is 126 ft. 6 in. long between centers of columns and weighs 277 tons. The next four are of 117 ft. 6 in. span, extending over all but one bay. These weigh about 208, 195, 136 and 136 tons respectively. The sixth truss, 90 ft. 3 in. span, and weighing 80 tons, extends between two interior columns. All these trusses carry columns for the superstructure.

The largest truss, No. 1, carries a load of about 2,030 tons, which is distributed over its entire length and divided almost equally between the two columns. The 117½-ft. trusses No. 2 and 3, weighing 208 and 195 tons, carry 2,200 and 2,025 tons respectively. In the next three trusses the distribution is not equal, since the 11-story superstructure extends over only about half the length of the truss. At trusses 4 and 5, there-

fore, the column at one end carries about 840 tons, while that at the other end, in the rear wall, carries only 425 tons.

Truss Design—The design of the trusses was governed somewhat by architectural considerations, web members having to be kept clear of corridors and other spaces, while knee braces are in some cases very shallow, to keep them above ceiling lines. Details of the 126½-ft. truss are given in Fig. 5. All the trusses are two stories high, 19 ft. 3 in. c. to c. of chords, with panels of approximately 17 ft. 6 in., but the panels are unsymmetrical in arrangement and some are as long as 21 ft. Strength requirements and height limitations necessitated heavy construction. Thus, the H-section of the chords has a horizontal web built up of four to six plates, while the vertical flanges have four or five cover plates each. The web members are also of H-section.

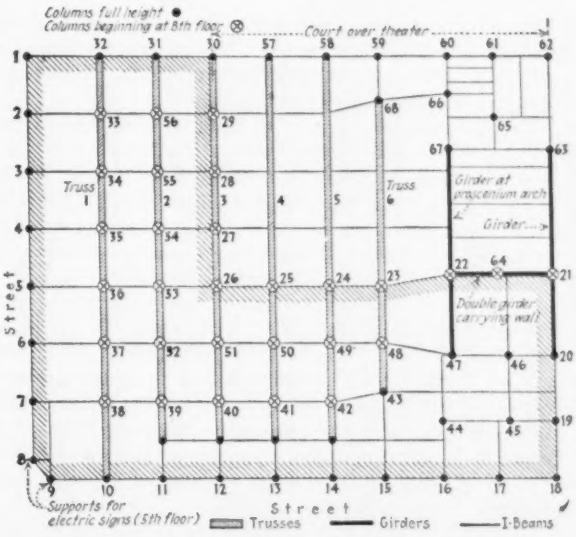


FIG. 3—FRAMING PLAN AT EIGHTH FLOOR

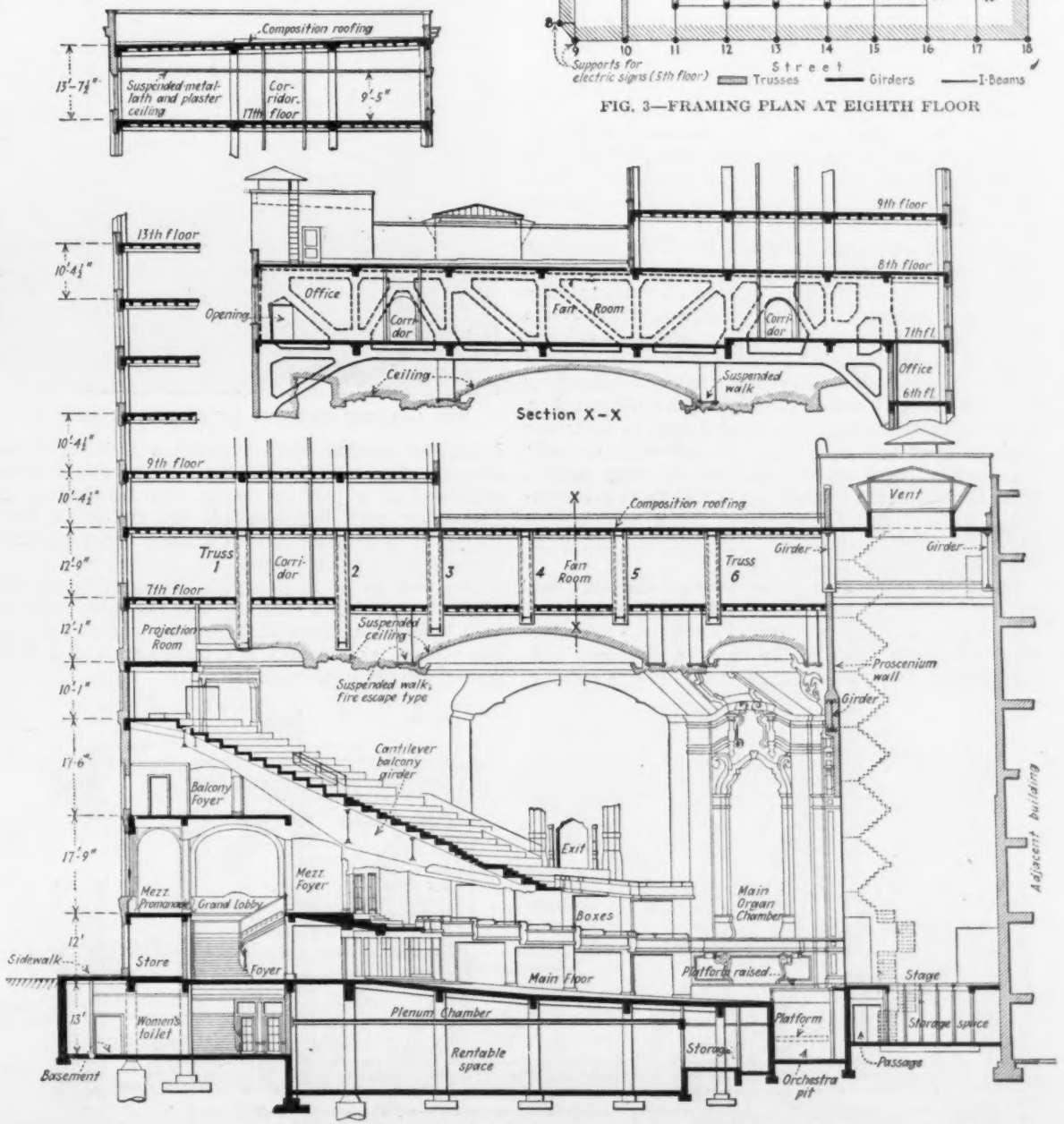


FIG. 2—SECTIONS OF AMBASSADOR THEATER BUILDING, ST. LOUIS

Some of the gusset plates are stiffened by angles along the edges to prevent buckling. The chords are wrapped with wire mesh and cased solid in concrete. Web members are fireproofed with walls of tile.

As an indication of the makeup of the heavy truss members it may be noted that in the 126-ft. truss the bottom chord is composed of 3 web plates 20x1⅛ in.; 2 web plates 17x⅞ in.; four angles 8x8x1⅛ in.; two filler plates 17x⅞ in.; six cover plates 24x1 in. and two cover plates 24x⅞ in. These cover plates are on edge, or in vertical planes, while the web is horizontal.

Girders and Columns—Beyond the trusses are two single-web plate girders of 64½-ft. span, 11 ft. deep, weighing 43 and 47 tons. This arrangement is shown in Figs. 3 and 6; one of the girders is over the stage front and the other is in the rear wall. Each girder carries a superstructure column. Between them is a double 42-in. girder, supporting the gridiron or fly gallery, which has an open floor of parallel I-beams and from which the scenery is handled.

All these trusses and girders are supported on columns 95 ft. long, weighing 30 to 40 tons and braced only on their outer sides. The columns are built-up H-sections, mainly 22x34 in., but those carrying the heavy truss loads are 22x37 in. and weigh about 1,000 lb. per foot. They are specially designed for stiffness in view of the high unbraced lengths.

Referring to the plate girders, it will be seen from the cross-section that there are two girders across the stage front or proscenium, both 64 ft. 8 in. in span c. to c. of columns. The upper girder, which is the heavier since it has to carry a superstructure column, is 10 ft. 6½ in. deep over flange angles, with a single 1-in. web which is reinforced at top and bottom by four side plates 12 and 16 in. deep. The stiffeners, Fig. 6, are pairs of double angles riveted back to back; one angle is short and is in direct contact with the web; the other is longer and extends over the flange angles. Since the angles are riveted together to form one member it was considered unnecessary to use a filler plate under the longer angle, thus reducing the weight of metal while providing ample rigidity.

The lower proscenium girder between the same columns is 5 ft. 6½ in. deep, with chords of channel section composed of four angles. Here the stiffeners are pairs of single angles fitted to the flange angles over web filler plates. Hangers attached to this girder carry a horizontal member which supports a 13-in. brick wall above the proscenium opening. From this member, composed of a pair of angles, the framing of the proscenium arch is suspended. To stiffen the lower girder, it is attached to the heavier upper girder at two points by riveted posts.

The wall girder in line with the upper proscenium girder is practically identical with the latter, but has knee brace connections to the columns. Between these two girders, at mid-span, is a transverse double 42-in. girder, already mentioned.

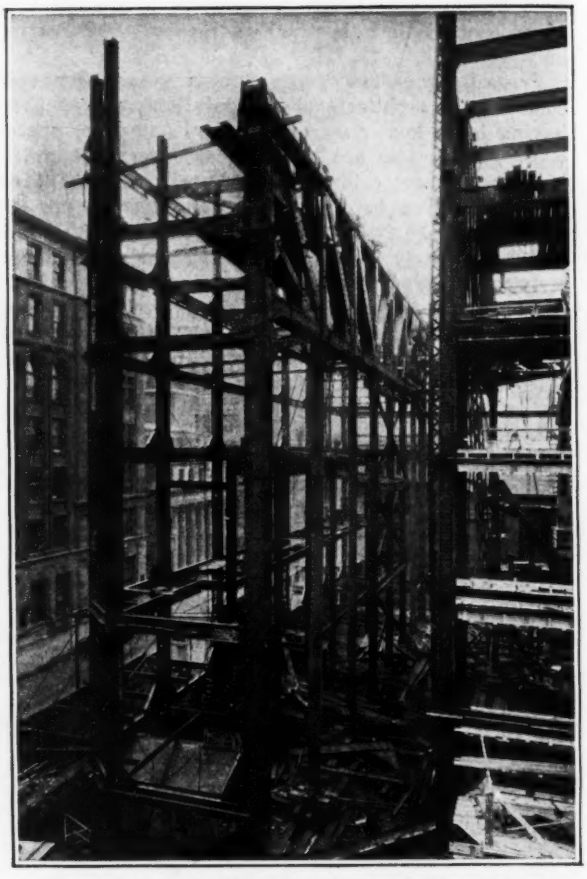


FIG. 4—TRUSS ERECTED ON TIMBER FALSEWORK

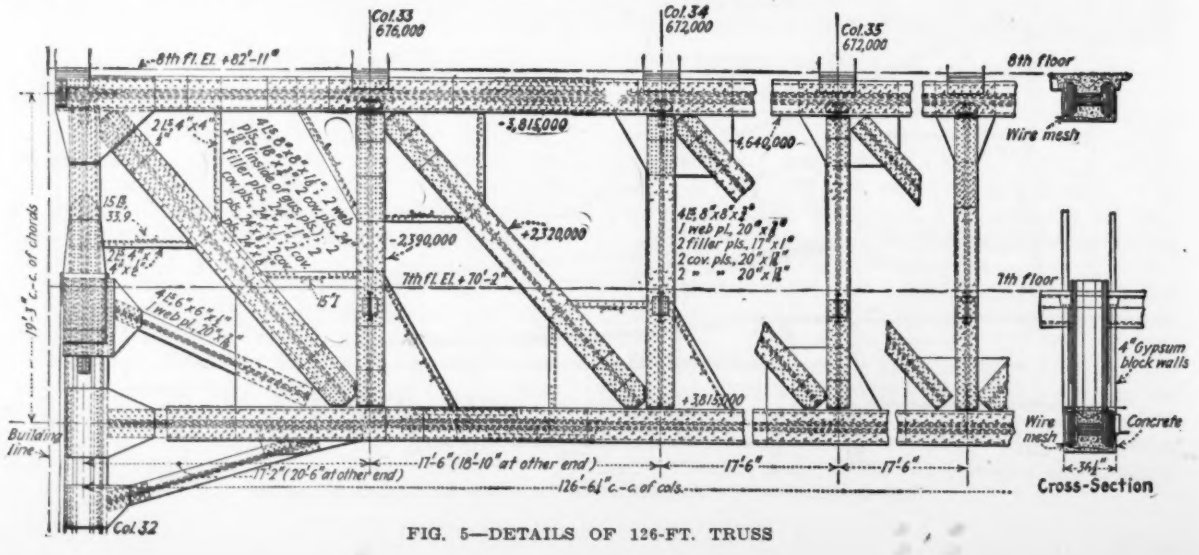


FIG. 5—DETAILS OF 126-FT. TRUSS

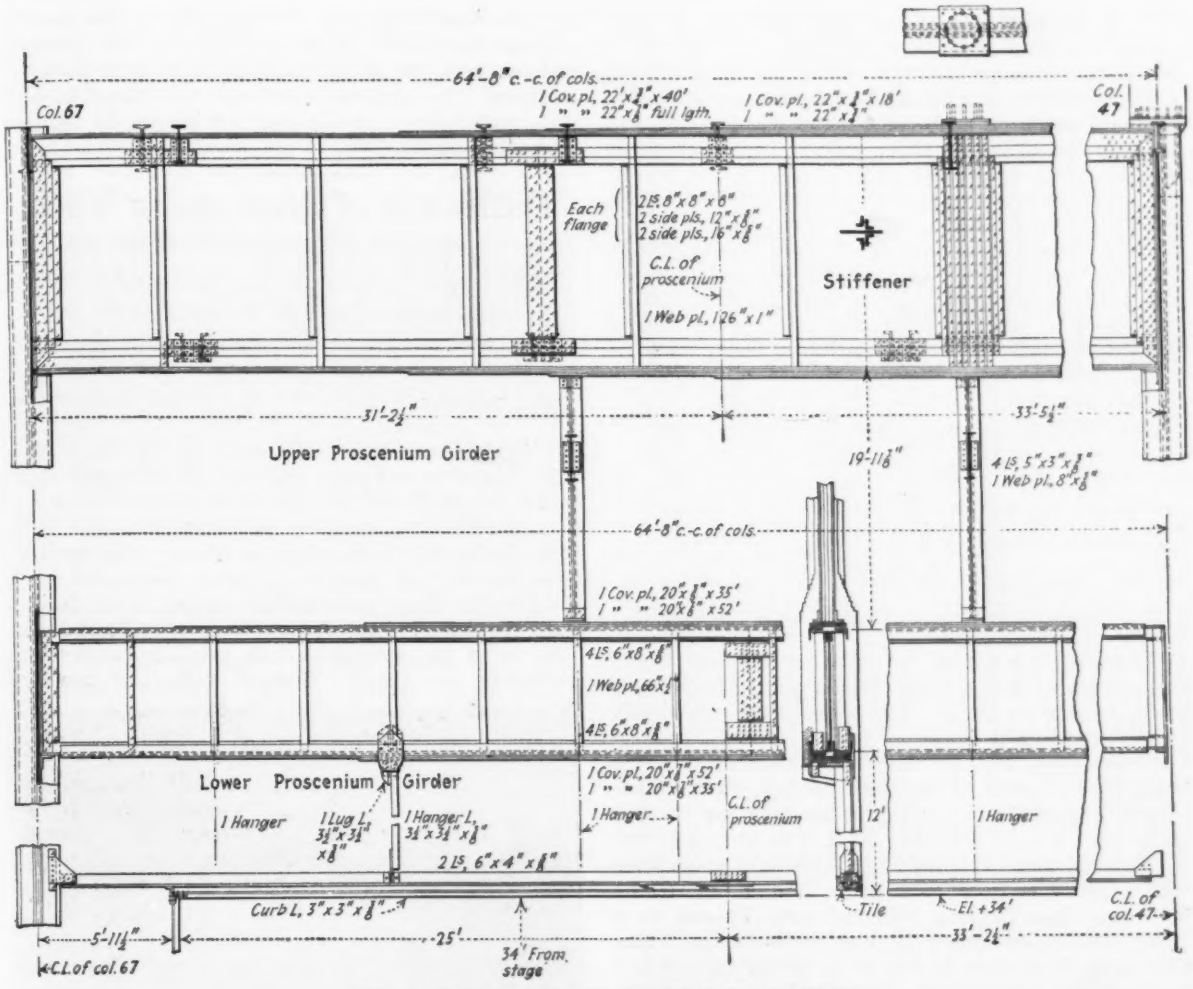

64'-8" c.-c. of cols.
Col. 67
Col. 47
1 Cov. pl., 22" x 1" x 40'
1 " " 22" x 1" full lgth.
1 Cov. pl., 22" x 1" x 18'
1 " " 22" x 1"
Each flange
2 Ls. 8" x 8" x 1"
2 side pls., 12" x 1"
2 side pls., 16" x 1"
C.L. of proscenium
Stiffener
1 Web pl., 126" x 1"
31'-2½"
33'-5½"
Upper Proscenium Girder
19'-11⅛"
4 Ls. 5" x 3" x ½"
1 Web pl., 8" x ⅜"
64'-8" c.-c. of cols.
1 Cov. pl., 20" x ⅞" x 35'
1 " " 20" x ⅞" x 52'
4 Ls. 6" x 8" x ⅞"
1 Web pl., 66" x ½"
4 Ls. 6" x 8" x ⅞"
Lower Proscenium Girder
1 Cov. pl., 20" x ⅞" x 52'
1 " " 20" x ⅞" x 35'
1 Hanger
1 Lug L., 3½" x 3½" x ⅞"
1 Hanger L., 3½" x 3½" x ⅞"
1 Hanger
C.L. of proscenium
12'
1 Hanger
2 Ls. 6" x 4" x ⅞"
Curb L., 3" x 3" x ⅜"
Tile
El. +34'
C.L. of col. 47
5'-11½"
25'
33'-2½"
C.L. of col. 67
34" From stage

FIG. 6—GIRDER FRAMING IN PROSCENIUM WALL

Cantilever Balcony Framing—In the balcony framing of the theater, the cantilever girders have no support forward of the rear wall of the auditorium, and therefore have unusual length of overhang, 41 ft. maximum (see Fig. 2). One of these girders is shown in Fig. 7. The anchor-arm length is about 35 ft., with the upper or anchor end attached to a plate girder in the fifth floor framing. These balcony cantilevers are plate girders sloped to the pitch of the balcony floor, which is of concrete formed in steps. In the rear auditorium wall are columns supporting the cantilevers, one under each girder; the cap plate of the column is inclined to fit the slope of the bottom chord of the girder. Cross frames are fitted between the girders, over the columns. An arrangement used in several theaters is to support the balcony cantilevers on a fulcrum truss spanning the auditorium, but in this St. Louis theater the support is in the rear wall of the auditorium.

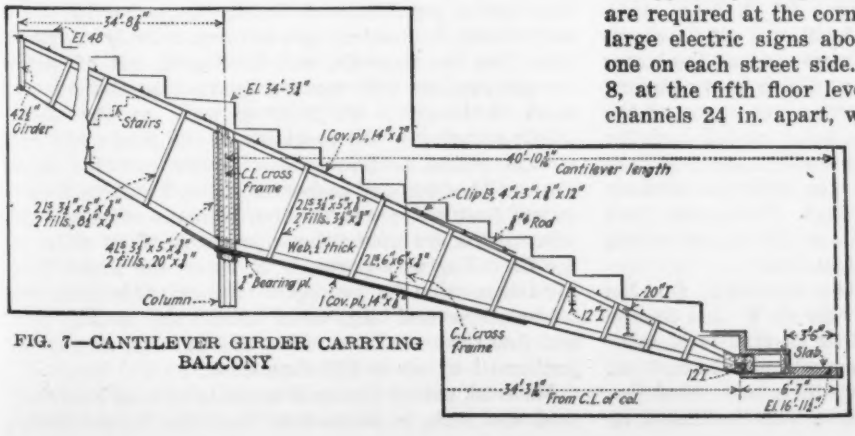


FIG. 7—CANTILEVER GIRDER CARRYING BALCONY

Supports for Signs—Special structural attachments are required at the corner of the building to carry two large electric signs about 78 ft. high and 8 ft. wide, one on each street side. Each of these supports, Fig. 8, at the fifth floor level, consists of a pair of 15-in. channels 24 in. apart, with diaphragms between them. These have a cantilever projection of about 11½ ft. from the corner column, or 10 ft. from the face of the building, and extend back to the columns as anchor arms attached to the interior framing. The sign, weighing about 12½ tons, has its upper end attached to similar cantilever bracing.

Floor Construction—Floors and roof are of reinforced concrete, of the slab and joist type, mainly 11 in. deep, including the 3-in. slab. In the corridors, however, the slab is dropped 2 in. to allow for a flooring of terrazzo, which is level with the finished slab surfaces in the offices on either side. These office floors

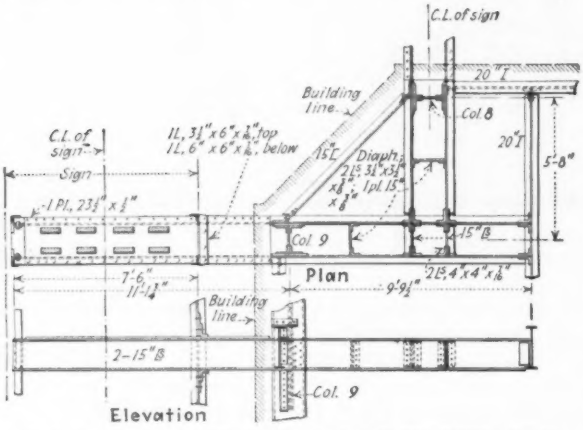


FIG. 8—CANTILEVER SUPPORTS FOR ELECTRIC SIGN

are designed for a live-load of 60 lb. per sq.ft., while the balcony is designed for 75 lb. and the main floor of the theater for 100 lb. The foundations are concrete piers sunk to rock.

Transporting and Erection of Steel—Owing to the large sizes of parts of the steel framing, careful planning was necessary to provide for handling and erecting them. The longest piece was 92 ft. 6 in. in length, and the heaviest piece weighed 54 tons; both of these were bottom chord sections of a truss. All pieces weighing more than 25 tons were delivered by rail to a switch track about one mile from the building. From that point they were hauled by a 20-ton tractor and trailer, with a second 40-ton four-wheel trailer on which was mounted a turntable. This hauling was done through the streets during business hours, without serious delay to traffic. Pieces weighing less than 25 tons were hauled from the steel contractor's Maplewood plant by means of a 10-ton tractor and two-wheel trailer. At the building, the steel was handled by a 25-ton stiff-leg derrick and a 50-ton guyed derrick, each with 100-ft. boom. Unloading the steel from the trucks was done with the guyed derrick, and both derricks were used in hoisting it into place.

Falsework for the erection of the trusses was built up of three 16x16-in. fir timbers 56 ft. long, cross-braced with planks 3x12 in. Additional single shores of 16x16-in. sticks 56 ft. long were used at the larger trusses to insure proper camber. These heavy timbers are shown in Fig. 4. Steel erection was begun at the stage or rear end, the derricks being moved back for the erection of each truss. The erection and field bolting averaged 5½ days for each truss, while the riveting, with four gangs, averaged four days. There were from 4,000 to 5,000 rivets in each truss, the largest rivets being 1⅛ in. in diameter and 12 in. long.

Architects and Builders—The architects for the Ambassador Theater Building were C. W. and George L. Rapp, with Lieberman & Hein as structural engineers, both of Chicago. For the steelwork, the contract was let to the Mississippi Valley Structural Steel Co., St. Louis, but the heavier members were fabricated by the American Bridge Co. at Gary, Ind.; the trusses and columns were assembled at the shop, rivet holes reamed and members then match marked and knocked down for shipment. The general contractor was the Boaz-Kiel Construction Co., and the steel was erected by the Ben Hur Erection Co., both of St. Louis.

Difficulties of Construction Work on the Island of Guam

Engineers on Isolated Naval Station Erect Steel With Natives, Use Salt Water in Concrete and Do Other "Impossible Things"

By P. J. Searles
Lieut. Commander (C.E.C.) U. S. Navy, Public Works Department, Navy Yard, Boston, Mass.

GUAM is rather a small island, 30 miles long by 7 miles wide, and about as far away from civilization as it is possible to get, being 5,500 miles from San Francisco, 1,800 from Japan or the Philippines, and 3,000 from Australia. Ships visit the island at intervals of from one to three months, bringing passengers, mail and freight. Guam is genuinely tropical. The island is under the control of the United States Navy Department.

As is to be expected certain peculiar construction conditions are found. General difficulties are encountered both in regard to labor and to materials. The native population of Guam, chamorros by name, and 15,000 in number, are a comparatively energetic race (for the tropics), and intelligent, but of course are not familiar with modern engineering methods and must be taught. All building work on the island, public or private, the operation of the power and cold storage plants, telephone lines, ferries, machine shops, blacksmith shops and carpenter shops, handling freight to and from ships, construction of roads and numerous other items are under the supervision of an officer of the Civil Engineer Corps, U. S. Navy, the writer holding the position for two years recently. Assisting this officer are several other naval officers and enlisted men, and American civilians, while the work is, in general, performed by about 500 chamorros.

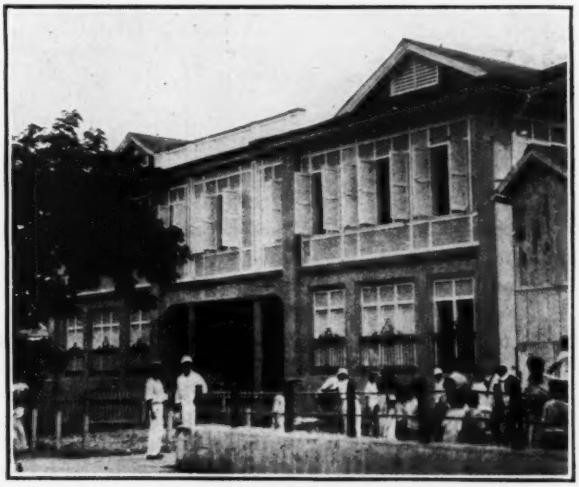


FIG. 1—CONCRETE POST OFFICE AND SCHOOL MADE OF JAPANESE CEMENT, CORAL SAND AND CRUSHED CORAL

Material, except for small amounts of local hardwood, sand and rock, is all secured from the United States,

Japan, and the Philippines. With infrequent and irregular steamer service, needs must be anticipated many months, and heartrending is the arrival of a ship containing say the bolts, roofing, sash, etc., of a steel building, but with the siding material still lying on a pier 5,000 miles away. Of course stocks of lumber, cement, nails, hardware, etc., are kept on hand, but too often the article wanted is not there. A full stock

FIG. 2—TYPE OF CONCRETE BRIDGE USED IN GUAM
Designed for over 50-ton load. The channel riprap is crushed coral or cascajo.

of spare parts for trucks, mixers, dredge machinery, etc., must be kept.

Field Decisions Govern—During the two years of the writer's stay in Guam, the principal construction work (as distinct from operation) consisted mainly in building concrete schools, a jail, water reservoirs, a post office and bridges, erecting a steel dredge, and constructing pipe lines, roads, frame buildings, bamboo and suwali structures. For concrete work, cement is secured usually from the Orient because of its cheapness, the aggregate is coral sand and a crushed metamorphosed coral known locally as "cascajo." The aggregate is not by any means up to American standards but is the only kind available. Salt water is frequently used for mixing, especially in the six months dry season when water is reserved for household purposes. With these handicaps, and the additional one of the labor not being, at its best, up to desired standards, the design depends not on theoretical formulas but on field practice and experience. In general the theoretical formulas are arbitrarily changed so as to give a considerably higher factor of safety, increase in amount of steel, etc., all to counterbalance poor materials and mediocre workmanship. Field decisions governed rather than drafting room design. One-story storehouses were not considered as needing the security of a two-story schoolhouse, and small dams were not so important as bridges. For bridges over small streams, up to 35 or 40 ft, concrete was used: above that steel was necessary because of the heavy (50-ton and upward) loads demanded by military considerations. Simplicity and strength were sought rather than fantasy in design.

Examples of Construction—Fig. 1 shows a two-story concrete building, the first floor being occupied by the post office, and the second by a school. In this structure an attempt was made to secure strength (including resistance to earthquakes which are of daily occurrence though of usually slight intensity), good appearance, and plenty of ventilation. Everything in the building is of Guam fabrication except the shell shutters, secured from Manila. The total cost was $18,000.

Roads are of "cascajo" and must be given constant attention by scarifying, placing a very thin resurface of "cascajo" dust, watering, and rolling with a 10-ton roller. As the island is quite hilly, and the annual rainfall is around 110 in. distributed 90 per cent in six months, drainage is a big problem. (Once in 1924 there was a fall of 29 inches in 30 hours.) Runoff is cared for by numerous concrete culverts, usually 3 ft. in diameter and capable of carrying at least 50 tons.

Frame buildings are of two kinds, those of Douglas fir with posts of concrete or "ifil" (a local ant-resisting hard wood), and galvanized iron roofing, and those of ifil and bamboo framing with nipa thatched siding and nipa or palm thatched roof. No frame building is at all permanent because of termite attacks, heavy typhoons, and general weather deterioration. Eight or ten years is the life of the best, so the government is gradually erecting replacements of concrete or steel.

Quite a problem arose in connection with the building of a 1½-yd. dredge, of all steel construction. The steel was fabricated in the Mare Island, Calif., navy yard, and erected in Guam. No chamorro had ever before seen a riveter in use, so it was necessary for the writer and two of his American assistants to teach a select few natives how to use the gun. At first hammers flew all over the site, but after a short time, fairly good workmanship was secured, although it was difficult to convince some workmen that the rivets had to be hammered hot and not cold.

Snow and frost are, of course, unknown, so pipe lines can be laid on the ground. Windows are not used, buildings being left open except in typhoons when they are closed with heavy shutters. Constant attention is essential to secure watertight reservoirs. Telephone poles must be heavily creosoted and set in concrete. Fresh concrete must be protected from the intense sun

FIG. 3—BARRACKS OF DOUGLAS FIR, CONCRETE POSTS AND ASBESTOS SHINGLES

and from the extremely heavy rains which will wash out the cement. Lumber invariably warps, shrinks and cracks.

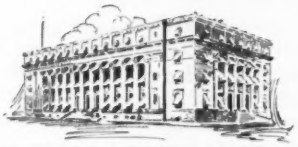
Common labor is 80c. a day, highest paid mechanics around $3.50. Living conditions are good. Relations between employer and employee are invariably pleasant. You learn the life history of the workman and his family troubles, help him in time of need, accept with real gratitude his gifts of cocoanuts, yams, plantains, or alligator pears, and when you leave the island look on your work with solid satisfaction as being one small iota of Uncle Sam's contribution to the people of the island, who are being raised from poverty and oppression to a position of happiness in their life and partnership with the United States.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities



FEDERAL BUILDING, MUSKOGEE, OKLA.

Muskogee, Oklahoma

COUNTY SEAT OF MUSKOGEE COUNTY, third city of the state, at the confluence of Arkansas, Grand and Verdigris Rivers, 65 miles southeast of Tulsa, approximately half-way between Kansas City and Dallas. Oil, gas and coal are produced in abundance to the north, west and south of the city, many wells having been drilled within the present city limits. An excellent quality of smithing coal is produced from strip pits nearby. Lead and zinc are found in the flint hills north and east. Four railroads have shops and terminals and two maintain general offices here. Principal industries are petroleum refining, cotton seed oil, paving brick, tractor hoists, iron, brass and bronze castings, structural steel, sand and gravel, electric fixtures, electric power, ice and food products. Trade is extensive in cotton, potatoes, fruits, oil and coal. An important distributing center with 87 exclusive wholesale establishments. For years important office for Indian affairs. Population 1926, estimate 40,000.

TYPICAL of so many Oklahoma cities of rapid growth, Muskogee's case is accentuated by the abundance of natural resources at its very door. Located here originally as a squatter town surrounding the Creek Indian Agency it was finally laid out by government surveyors parallel to the Missouri-Kansas-Texas R.R., which was the first railroad into the territory back in 1871. The railroad picked this location as the shortest Arkansas River crossing available. Capt. H. V. Hinckley, long a strong engineering character of note in Oklahoma City, only recently deceased, laid out the town, largely in accordance with the wishes of leading citizens who were also gun-toters. In consequence, uncertain lot lines, street jogs and all the ills of indefinite boundaries remain to bother the city engineer. No censure is intended of Captain Hinckley; the surveyors of those days did the best they could under the circumstances and live.

Based on these early conditions, street widths today are a compromise. The main through streets east and west, Okmulgee Ave., 109½ ft. wide, and Broadway paralleling it, 90 ft. wide, connect with arterial highways of the county. Many of the other streets are 80 ft. wide, giving the characteristic open appearance of so many western cities. In plan, the city is an irregular rectangle 4 miles wide and 8 miles long, with 180 miles of streets. With the rivers for water supply, plenty of fall for sewers, abundant sand and gravel, ground water not ordinarily a problem, and foundations good, the engineers' problems are relatively simple.

Soil conditions within the city are fairly uniform. The top is a brown, sandy clay loam which powders in summer and becomes boggy in winter. Generally the subsoil is a yellow clay. Shale and sandstone are encountered near the surface in some sections. Stratification is almost uniformly northeast to southwest. No unusually difficult problems have been encountered in excavations. Sewer profiles are all drilled out however, before estimates are made to insure a reasonably accurate estimate of earth classification.

City Engineering—Under the executive direction of the city manager the city engineer, John R. March, has charge of new construction of all departments, is supervisor over the maintenance of paving, sewers, water-works and all municipal structures. He is adviser upon structural and many other technical problems arising in all departments; is judge and jury on many property line disputes and checks all special consent lists which accompany applications for permits to establish places of business outside of business zones. He keeps all engineering and utilities records. He is not responsible for garbage collection, fire or police, finance, library, hospital or cemetery, except when called upon for advice or co-operation.

Paving and sewers are constructed by special assessment districts in strict accordance with the laws of Oklahoma. Preliminary work is carefully and accurately prepared and it has seldom been found necessary to change details after starting construction. Several miles of sanitary sewers are now being planned and it is expected that about 30,000 yd. of paving will be laid this season, practically all of concrete. A municipally-owned asphalt plant is maintained and does some paving in parks and at widened street corners aside from maintenance work. The paving specifications provide for slump tests, compression strength tests and surface smoothness for all concrete. Asphalt work is controlled by a skilled inspector in the engineer's own laboratory. Card progress records are kept of all the steps of a paving district operation.

Work and stop orders are issued to contractors after observing the recording barograph and relating its indications with the reports from other meteorological stations within the district. Consequently, very little damage is suffered from storms. Last year five slabs of concrete were saved from sudden downpours which the engineer was able to forecast. The contractor demurred a good deal over stopping work and hustling tarpaulins on a sunshiny day but got his work covered just in time to save it.

All changes from original plans are noted on the job tracings and on completion of the work the essentials are entered on atlas sheets. Separate atlas books for paving, sanitary sewers, storm sewers and water mains are kept up to date for public use. The engineer also has on the public counter a fire insurance atlas, which has proved helpful to the public. The outlines of the shape of the buildings greatly assist people in explaining their problems to the city manager or to the engineer. An aerial mosaic, the result of work by a nearby army flying station, is also on display in the engineer's office.

Office space is cramped and there have not been sufficient funds to organize and keep up all records desired, such as a property ownership atlas, paving cuts, cost

accounting and motor transport efficiency records which the engineers feel are essential.

Natural drainage is excellent, and in four directions. Two outfalls carry sanitary sewage to the Arkansas River. Only a few outlying sections are without sanitary sewers, and in these many septic tanks are being constructed. Storm sewer construction is considerably behind present requirements, but with the exception of a few low districts the people are not complaining. There are 97.2 miles of sanitary sewers and 28.6 miles of storm drains.

Some of the Problems—The arterial highways leading from the city traverse in every instance sparsely settled areas within the city limits where valuations are low. Mr. March's hopes for their improvement with permanent paving by special assessment are not optimistic at present. The adjacent owners oppose every attempt made, saying that the city and state should maintain and construct the arterial roads.

There is desperate need of adequate and fireproof quarters for municipal and county offices, yet every attempt to provide safe places for the public records is met with strong factional and sectional opposition. It may take a disastrous fire to bring about a majority in favor of a new building.

TYPE AND AMOUNT OF PAVEMENT ON STREETS AND ALLEYS IN MUSKOGEE

Type	Streets 100 miles Sq.Yd.	Alleys 80 miles Sq.Yd.
Unsurfaced		
Gravel—all classes	204,000	26,000
Waterbound macadam	27,000	.....
Surface-treated macadam	29,200	.....
Bituminous macadam	42,200	15,800
Bituminous concrete-mixed	23,450	8,310
Sheet asphalt	741,260	2,300
Concrete	50,700	16,700
Brick, asphalt filler	60,000	2,750
Brick, cement grout	70,000	8,000
Cinders	6,000	2,000
Total paving	1,253,810	81,860

NOTE—The above is equivalent to 7 miles of gravel and 73 miles of pavement.

The water-works system has had little spent on improvements in the past six years, and is steadily falling behind the demands upon it. Changing conditions, due to tourists and campers throughout the watershed of the Grand River, from which the city's supply is derived, are making the necessity for a filtration plant more and more pronounced. Last year the citizens rejected by a large majority a proposed bond issue of $225,000 for this purpose. The engineer foresees the necessity of soon bringing up the matter again. A substantial increase in the amount will be needed to provide for new mains and new pumps. Numerous small improvements now underway are being paid for out of the general annual budget allowance. It is estimated that not less than 8 miles of service mains and 100 fire hydrants are needed at once to meet the demands, in addition to $50,000 for feeder mains.

These problems are simple, however, when compared to those confronting many southwestern cities. For five months out of each year the water has a turbidity of less than 20 p.p.m. It is chlorinated but enough is available even in dry periods to supply the entire state. The total settling storage is 10 m.g. A three day's supply is available but ordinarily 32 to 40 hours is the detention period. A chlorine dose of 6 lb. per m.g. is applied to the clear water but in summer moss comes in and hypochlorite is used in the raw water. Gas is burned under the boilers but oil storage is provided and could be utilized by a change-over in half a day. There are 73.9 miles of mains. The town is metered and bills are rendered monthly.

Services—Garbage is collected twice a week in the residence districts in winter and every other day in summer. Every day the business district is served. Private scavengers take the larger part of the garbage but in summer the city incinerator handles 25 to 30 tons. The plant is of the low-temperature type but one high-temperature furnace using gas has been installed.

Collection of broken glass is a novel feature of service the city performs. Police and city employees report glass and it is removed by a high school boy working from 4 to 10 p.m. who rides his motorcycle over regular routes from ward to ward reporting in from police and filling stations.

Street cleaning in the business district is accomplished at night by horse-drawn pressure flushers. The residence streets are served by the broom-and-cart method.

Zoning is operated on the local option basis, 75 per cent of frontage consent being essential within 300 ft. of proposed unusual use. Adjudication of certain cases is now four years old.

Attendance at a special council meeting (Muskogee has a council-manager form of government) called to decide on the question of what to do with a sidewalk placed several feet out in a parkway disregarding the engineer's stakes, disclosed the fact that all concerned highly respected the engineer and his views. Personal desires to save a misplaced hedge where the walk should have been had to give way to appeals for the common good. No guns were in evidence. Captain Hinckley would have rejoiced to know of the upholding of the engineer.

Four or five immediate and pressing problems are before the engineer, and, as is so often the case, he is too frequently held to account for troubles not within his power to correct so long as undue economy prevails.

Mr. March has a draftsman who also acts as rodman and a general assistant. During construction periods the staff is increased as required with field parties and inspectors. Including upkeep of cars and all supplies for four years' construction of $708,000 the cost was $43,097. Of this $6,000 is estimated as interdepartmental service, making the net engineering cost 5.2 per cent of the new work.

Public Water Supplies in Haiti

Ten municipalities in the Republic of Haiti had water-works on Sept. 30, 1925, according to the recently published report of the engineer in chief of Public Works, Commander F. H. Cook (CEC) U. S. N., whose headquarters are at Port au Prince. The place just named and Pétionville have joint works with 2,986 subscribers or considerably more than half of the 4,971 subscribers in the ten municipalities. Besides the nine water-works supplying ten municipalities the Government, up to the date named, had sunk 41 wells in 13 towns and villages of the Department of the North and had recently put in operation an additional well-drilling rig in the Department of the West.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Needed Book on Movable Bridges

REVIEWED BY HOWARD C. BAIRD
Consulting Engineer, New York City

MOVABLE BRIDGES—By Otis Ellis Hovey, B. S., C. E., M. Am. Soc. C. E., M. A. S. M. E., M. A. S. T. M., M. A. S. T., Assoc. M. A. R. E. A., Assistant Chief Engineer of American Bridge Co. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 352; many line cuts and half-tones; appendices carrying mathematics of subject. $6.

The author of this work is peculiarly fortunate in that he has been for many years in close contact with a wide range of modern draw span construction. The timeliness of the book will be apparent when we consider that, although movable bridges are included in textbooks on bridges, no volume treating of that subject exclusively has appeared in recent years.

A historical introduction begins with interesting descriptions of draw bridges of antiquity and illustrations of prototypes of the modern swing span and the bascule as first used in fortifications and later for spanning canals and small waterways among the European docks. The brief historical matter presented calls attention to the fact, not always realized, that the evolution of the movable bridge has about kept pace with that of other branches of engineering.

Under types of movable bridges a much needed exposition is given of the characteristics of the eight classes into which the author divides such structures. We here find a statement of general principles that assist the engineer in arriving at a proper choice of type, and a dissertation on the advantages and disadvantages of each, particularly valuable in view of the conflicting claims of rival patentees. It is well also that an authoritative statement of the merits of the ordinary swing draw span should be set forth in this work, as it has all too frequently been thrust into the background by interested advocates of other types until many have gained the erroneous impression that the swing span is obsolete. It cannot be controverted that (to quote from the book) "when conditions at the site are favorable and there are no restricting circumstances," a swing bridge is the simplest, best and most economical type in first cost and maintenance.

Swing bridges, bascule bridges, and vertical lift bridges are each treated in a separate chapter illustrated by a profusion of instructive diagrams of the various kinds of each type, with numerous tables and charts of obvious aid to the designer and estimator. Such charts as given in Chap. III, showing curves plotted in accordance with the weight of actual designs and tables of weights and machinery percentages, are invaluable as a guide for making approximate estimates. For the engineer ambitious to develop improvements in the bascule and vertical lift, tables of patents granted for these types will prove interesting.

Rim-bearing and center-bearing swing bridges are compared, and the superiority of the latter is established by thorough experience in design and by cost history of shop and field. A good example of the "shear pole" swing span for small openings is also given. Comparison of different arrangements for distributing the load over the drum of a swing span places the matter clearly before the designer and, as it is the result of a study of failures in actual turntables, its value is self-evident.

The author remarks that it is not feasible to describe all the designs that have been proposed for balanced bascule bridges. He has, however, selected upwards of twenty structures for illustration and description, beginning with the bascule over the Tiber in Rome (before 1893) and the Tower Bridge in London (1892-3) and concluding with the "American Bridge" type across the River Rouge at Detroit. These examples should be generally sufficient for the purpose for which the work is written.

Under vertical lift bridges, a description of the ingenious type patented and built (1870-1880) by the justly renowned Squire Whipple is a fitting opening to the chapter on what is distinctly an American development. The early English and French lifts referred to are small, and, although ingenious, are of interest only historically. Beginning with the Halsted St. bridge in Chicago (1893) the three well-known patented types now in general use in the United States are described in detail and well illustrated by photographic views and instructive diagrams.

The theoretical treatment of the problems of design for superstructure of movable bridges is the most important part of the book. Nearly 100 pages cover this subject in four chapters, Continuous Girders, Analysis of Swing Bridges, Analysis of Bascule and Vertical Lift Bridges, and Elastic Deformations of Beams, Girders and Trusses. The manner in which theoretical considerations as affected by practical limitations are presented is an evidence of the author's personal experience in wrestling with the many vexatious problems that arise in the designing of an economical structure to be economically operated—which are often not suspected until the designer is brought face to face with inexorable conditions.

The reader is assumed to be familiar with influence lines, Maxwell's principle, and general flexure formulas. Two subjects are fully treated, however: the theorem of three moments together with tabulations for reactions for continuous spans, the area-moment method of Greene & Ellis for calculating deflections of beams. These are brought into use in the analysis of swing bridges in Chapter VII, where the application of theoretical principles is used in excellent examples of spans taken from actual practice.

The analysis of the swing span would not be complete without including the "double swing," although this type has had a very limited use. Another reason for giving the theoretical treatment of this problem is its application to the analysis of the double-leaf bascule, as the reader quickly discerns.

Under Details of Design, a most useful chapter the requirements for satisfactory service are set forth. Preceded by an example of camber calculations, and the mechanics of the end wedges and their operating ma-

chinery are given very completely with the calculations for stress for which the sizes in an actual bridge were fixed. Other known types of end lift are illustrated and described in detail. A discussion of the action of the disk center is closed with a table of dimensions for disks and the corresponding pedestals and pivots for a wide range of loads. A complete analysis of disk stresses in Appendix *A* is of special interest, probably the first theoretical treatment of the problem.

Failures in the treads and segmental girders in some of the early rolling lifts were the result of incomplete rational analysis, and later designs were improved to correct the faults brought to light, but a theoretical treatment of the problem involved has never appeared in a textbook on bridges, so far as the writer knows. Appendix *B* ably covers the subject and exhibits an example worked out by a method that is necessarily approximate but is founded on rational theory and that should "enable the designer to make his calculations from data normally developed during the design of the supporting girder."

For the engineer who has experienced some of the troubles resulting from counterweights inaccurately estimated, Chapter XIII should be a welcome addition to his data on the subject.

While at first reading it might seem that the turning machinery should have been included like the end lifting machinery and center disks, it becomes apparent that the turning machinery differs in carrying no live-load reactions and in serving for operation only. As adequate treatment would require so much space as to justify a volume of its own, the author plans to publish a second volume, to deal with power and operating machinery.

The book is not encumbered by structural details that are not draw span problems; the phrasing is agreeably terse and the style simple, as becomes the engineer writing for other engineers, so that to follow the demonstrations which have been presented in so thorough a manner is not difficult. Both text and drawings are exceptionally clear.

British Psycho-Industrial Research

INDUSTRIAL PSYCHOLOGY—By Charles S. Myers, Director of the National Institute of Industrial Psychology, M. Industrial Fatigue Research Board, Fellow of Gonville and Caius College, Cambridge, Fellow of the Royal Society of London. New York: The People's Institute Publishing Co., Inc. Cloth; 5x8 in.; pp. 164; 18 halftones and line cuts. $2.50.

In the five lectures at Columbia University which are the basis of this book the author first outlines the history and mechanism of certain psycho-industrial research institutions which have operated in England of late, then summarizes the methods and results of their investigations. Industrial fatigue, motion study and vocational guidance are treated. The volume should be of interest and value to investigators and students in the field it covers, to factory and shop managers and owners and to many engineers. The author states that in England labor has been more sympathetic and cooperative than management in the work he describes. He severely criticizes the motion study work of Taylor and Gilbreth because it dealt with men as if they were machines, using engineering rather than psychological methods of research. He makes no claim of finality for the British studies which he describes, although presenting conclusions which he thinks contribute materially to the science of industrial research.

A Manual of Concrete Practice

AMERICAN CONCRETE INSTITUTE: Proceedings Chicago Convention, February, 1926. Vol. XXII. Detroit, Mich.: American Concrete Institute, 2970 West Grand Boulevard. Cloth; 7x9 in.; pp. 796; line cuts and halftones. $5 to members, $8 to non-members.

Of much more than ordinary technical interest is the 1926 *Proceedings* of the American Concrete Institute. One expects to find in such volumes a plethora of concrete construction. It is to be noted also that varied stages of study, with the actual meaty manuscript material occupying a comparatively small space. This year's *Proceedings*, however, include some 600 pp. covering the newest phases in the advance of the art of concrete construction. It is to be noted also that this year the Institute has "spread itself" in presenting pictorially what the text recites.

Among the thirty principal papers, many of which are profusely illustrated, the following are cited as indicative of the wide field the Institute is covering: Formulas for the design for rectangular floor slabs and supporting girders, permanent railroad track, earthquake-proof construction, seven years' experience with the job control of the quality of concrete, use of the water-ratio specification, suggestions on the decorative use of concrete, concrete units in building codes, effect of lime on concrete products, ornamental concrete floor surfacing, transverse testing of concrete, tests on a 300-ft. concrete chimney, extensibility of concrete, the effect of varied curing conditions on the compressive strength of mortars and concrete, relation of 7- to 28-day compressive strength of concrete, soap as integral waterproofing, and correlated considerations in the design and construction of concrete bridges.

Altogether, the volume is really a manual, in essence, of the present status of concrete as a structural material.

Text Less Pessimistic Than Title

SATURATED CIVILIZATION—By Sigmund Mendelsohn. New York: The Macmillan Co.; Cloth; 5x8; pp. 180. $1.75.

The thesis of this book is that civilization has a rhythmic movement; rising to a saturation point, swinging back, rising, falling and so on, and that just now we are approaching saturation. In support of this thesis the author briefly reviews past cycles of civilization, then takes up in more detail the present cycle, beginning substantially with the nineteenth century. Of the ten chapters on the present cycle, five deal with labor. The others take up economic saturation, limitation of mechanical inventions and exhaustion of natural resources; labor deterioration; saturation of material indulgences; and political and social saturation.

Whatever the author's intent, his data and most of his own interpretation of it are far more optimistic than his thesis and the title of his book seem to imply, especially as regards the present cycle.

Some of the examples of saturation fail to prove the author's case because they deal with a part only of a great field. Thus, while it is true that railroad construction reached the saturation point some time ago ways and means of transportation as a whole did not and there is no prospect that they will for a long time to come, as witness the construction of improved highways and their use by private and public motor vehicles, besides which aerial transportation is yet in its infancy. In other words, when or perhaps before one field is saturated or exhausted another one in the same region is opened for cultivation. Moreover, saturation in

America does not necessarily mean saturation in Europe, much less in Africa or Asia. The same is true of the various classes of humanity as regards a great variety of material and other needs—like education, for instance.

Applied Mechanics in a New Light

REVIEWED BY GEORGE PAASWELL
Structural Engineer, New York City

APPLIED ELASTICITY—By S. Timoshenko, formerly Professor of Mechanics in Kiev and Petrograd Polytechnical Institutes, research engineer, Research Department, Westinghouse Electric and Manufacturing Co.; and J. M. Lessells, B. Sc., Westinghouse Electric and Manufacturing Co. East Pittsburgh: Westinghouse Technical Night School Press. Cloth; 6x9 in.; pp. 544; 391 line cuts, 95 tables. $6.

It is singularly fortunate that a number of European scholars, having taken residence in this country, have decided to publish the results of both their own researches and of research work in allied fields. The application of the theory of elasticity to modern structural design has been seriously hampered by the inability of writers to translate the difficult mathematical analysis into practical formulas and there have been hitherto few points of contact between this abstract theory and our usual treatises on applied mechanics and strength of materials.

The text here considered seems to make the maximum possible application of elastic theory to the practical problems of construction. The formulas presented are all of easy application to the many problems involved. After first covering the analysis of the simple types of structures subjected to tension and compression, flexure and torsion and to the various combinations of these elementary force systems, the authors proceed to apply the results to the more unusual types of structures, with special application to the complex units used in machine design. Flexure is treated in a remarkably comprehensive manner, bringing to the attention of the reader the vast literature that has been developed since the first publication of St. Venant's classic treatise of flexture and torsion. A combined graphic and analytical application of moment areas gives a very efficient method of analyzing beams, both for stresses and for deformation. An interesting discussion is that of the flexure of a continuously supported bar on an elastic foundation, a very important problem in application not only to track structures but to the general theory of foundations, and one that seems capable of extension into the realm of soil mechanics.

It has long been recognized that a sharp change in the outline of a bar or plate, such as a notch or a hole, brings about a large increase of stress at this discontinuity. The authors give an elaborate treatment of this phenomenon. It has been pointed out that in ductile materials a process of readjustment lessens the effect, but that in brittle materials, such as high-carbon steels and hard bronze alloys, the stress accumulations persist up to ultimate failure. These effects are, of course, magnified under stress induced by impact or vibration.

Unfortunately Poisson's Ratio does not appear to receive wholly satisfactory treatment at the authors' hands. This ratio is a measure of a distinct molecular change and can hardly be translated into terms of stress. It seems that a simple work equation would show the danger of attempting to introduce this ratio as a stress equivalent. However, it is only fair to state that none of the formulas in the text appear to be predicated upon the wrong use of this ratio.

A number of the formulas given are dependent upon an intricate mathematical analysis which has been omitted in the text. This is, of course, a dangerous proceeding, in that the reader has no check upon the correctness of the formula, but ample reference is given to complete analyses, unfortunately most of them in foreign languages.

Throughout the text, important analysis is based upon the application of the solution of differential equations. The fact that most schools omit such a course in their engineering education inevitably proves a serious handicap to every serious student of structural design. In view of the modern trend toward a more conscientious analysis of important structures, it seems imperative that such a course be included in a rational engineering training.

The text emphasizes the importance of methods of analysis based upon the energy of deformed bodies. The present as well as other works reveals what a powerful weapon the work method can prove in the hands of a skilled investigator. Not only may fundamental equations be derived by this method, but the application of such equations to concrete problems is rendered simple and direct. That the method demands somewhat more mathematical training is at worst a minor disadvantage.

There is a very complete treatment of columns. Again the formulas are placed in such form as to illustrate the effect of composite loading upon their reduction to standard form when such loadings become negligible. This is a very important point, since the introduction of a new formula brings no fruitful results until the reader can see at a glance the difference between the new and the usual expressions. The trigonometric series lends itself well to the development of formulas of such illustrative type.

There is a chapter on flexure of plates, following the usual treatment of an inextensible mid-surface. However, a more exhaustive study of plates, that can be recommended to those familiar with German, is given in a text by A. Nadai.

The second portion of the book presents, for the first time before the American engineering public, a comprehensive study of the phenomenon of failure. It contains a complete study of not only the effects of initial treatment of the material but also its physical behavior at high temperature. The tests quoted emphasize the importance to the engineer of elastic after-effects. In these may be found a record of the crystallographic history of the material, and their study aids intelligent analysis of the influence of heat treatment. The tests demonstrate that it is necessary to make observations on models that are geometrically similar to the full-size member.

The question of proper design to effect a balanced structure when several types of stresses coexist has been the subject of dispute for several centuries. It seems that Mohr in his maximum-shear theory presented the most logical method of design, and it is probably the one that meets most consistently the results of a laboratory study.

The effect of static and dynamic loading, as well as of reversed and repeated loadings, is comprehensively treated, together with the effect of temperature upon

the ultimate strengths of material. Most of the data presented are of particular importance in the study of stresses induced in machines. No mention is made of the action of reinforced-concrete bodies.

The reviewer cannot emphasize too strongly the great range of structure types treated, and also the comparative ease with which the average reader can follow the analysis. It is no mean tribute to the intellectual equipment of the authors to state that, both as to amount of original research contained and as to refreshing novelty of treatment, this is probably as important a text on engineering structures as has been published in the last twenty-five years.

PUBLICATIONS RECEIVED

LUMBER is one of the latest publications in the series devoted to elimination of waste, simplified practice (15c. from Superintendent of Documents, Washington, D. C.).

FINANCIAL STATISTICS OF STATES for the year 1924, compiled by the Bureau of the Census, may be obtained for 20c. from the Superintendent of Public Documents, Washington, D. C.

SHEAR TESTS OF CONCRETE BEAMS, by Willis A. Slater, engineer physicist, Arthur R. Lord, consulting engineer, and Roy R. Zipprodt, associate engineer, forming Technologic Paper No. 314, U. S. Bureau of Standards, may be had for 50c. from Superintendent of Documents, Washington, D. C.

METHODS AND COSTS of making and laying 24- and 30-in. precast concrete pipe as a substitute for anti-malaria drainage ditches at Emporia, Va., are described in Reprint 995, from U. S. Public Health Reports, March 13, 1925 (5c. from Superintendent of Documents, Washington, D. C.). The paper was written by George S. Bote, scientific assistant, U.S.P.H.S.

A THESIS for M.Sc.C.E. on The Stove Pipe or California Method of Well Drilling as Practised in Arizona, by Harold C. Schwalen, has been revised and published as Bulletin 112 of the Arizona Agricultural Experiment Station (University Station, Tucson, Ariz.). Including illustrations, it covers some 50 pp. It should be of interest and value for well drillers who can make use of this method.

A CITY PLANNING PRIMER of a dozen mimeographed pages is being distributed by the United States Department of Commerce. The primer was prepared by the Advisory Committee on City Planning and Zoning, Division of Building and Housing, of the department. Among its members are Charles B. Ball, municipal engineer, Chicago; Morris Knowles, consulting engineer, Pittsburgh, and F. L. Olmsted, landscape architect, Brookline, Mass.—The Department of Commerce has also issued a revised directory, as it might be termed, of cities that have adopted zoning ordinances and of state legislation authorizing zoning.

RECENT PUBLICATIONS of the Engineering Experiment Station, Iowa State College, Ames, Iowa, which apparently may be had free of charge "while they last," include Experimental Impact Studies on Highway Bridges by Almon H. Fuller, professor of civil engineering, and Robert A. Caughey, associate professor of structural engineering; a Civic Survey of an Iowa Municipality, being a preliminary report on a city plan for Mason City, by Rolland S. Wallis, municipal engineer; and Better Operation for Iowa Sewage-Treatment Plants, a short paper by Hans V. Pedersen, sanitary engineer, Iowa State Department of Health.

THREE THOUSAND EXPERIMENTS (actually 3001) on the flow of water through 12, 18, 24 and 30-in. pipe culverts of concrete, vitrified clay and corrugated metal and through various sizes of concrete box culverts, made jointly by the U. S. Bureau of Public Roads and the State University of Iowa, at the hydraulic laboratory of the latter, are reported in The Flow of Water Through Culverts, Bull. 1, Studies in Engineering ($1 from The University Editor, Iowa City, Iowa). The authors are David L. Yarnell, drainage engineer, U. S. Department of Agriculture, Floyd A. Nagler and Sherman M. Woodward, associate professor and professor of hydraulics at the institution named.

FOUR PAPERS on Stream Pollution compose Reprint No. 1063, U. S. Public Health Reports, Jan. 15 and Feb. 5, 12 and 19, 1926 (10c. from Superintendent of Documents, Washington, D. C.). Titles and authors follow: (I) A Review of the Work of the United States Public Health Service in Investigations of Stream Pollution, by W. H. Frost, Surgeon. (II) The Rate of Deoxygenation of Polluted Waters, by Emery J. Theriault, Associate Chemist. (III) The Rate of Atmospheric Deaeration of Sewage-Polluted Streams, by H. W. Streeter, Sanitary Engineer. (IV) Quantitative Studies of Bacterial Pollution and Natural Purification in the Ohio and the Illinois Rivers, by J. K. Hoskins, Sanitary Engineer.

DESIGNED PRIMARILY for officers of the U. S. Coast & Geodetic Survey, those out of the service who have any great amount of precise triangulation work to do will find valuable the recently issued manual of First-Order Triangulation, by C. V. Hodgson, assistant chief, Division of Geodesy. "First-order" indicates the most precise work done by the Geodetic Survey, wherein no greater average angle closure than 1 sec. is allowed, and the closure in length upon a measured base or a line of adjusted triangulation must not exceed that represented by an error of 1/25,000. This is in accordance with the recent adoption by the Geodetic Survey at the suggestion of the Federal Board of Surveys and Maps of standard nomenclature wherein first-order, second-order, third-order and fourth-order represent the four grades of vertical and horizontal control. Though the pamphlet is meant particularly as a manual for Geodetic Survey officers little or no attention has been paid to historical developments or to theoretical discussions. (40c. from Superintendent of Documents, Washington, D. C.)

New Books and Revised Editions

[*Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.*]

ARCHITECTURAL CONSTRUCTION, VOL. TWO: AN ANALYSIS OF THE STRUCTURAL DESIGN OF AMERICAN BUILDINGS—By Walter C. Voss, S. B., Consulting Engineer, Boston, Mass., formerly head of Department of Architectural Construction, Wentworth Institute, Boston; and Edward A. Varney, S. B., Structural Engineer, Cambridge, Mass., formerly Instructor of Mechanics and Structural Design, Wentworth Institute, Boston. Book One, Wood Construction. New York: John Wiley and Sons, Inc.; London, Chapman and Hall, Ltd. Cloth; 9 x 12 in.; pp. 224; 203 halftones and line cuts, $6.50.

DER BEHÄLTERBAU: Ein Handbuch für die Berechnung und Ausführung eiserner Flussigkeits—und Gasbehalter—Von Ernst Broschat. Teil I: Konstruktionselemente. Leipzig: Otto Spamer. Paper; 6x9 in.; pp. 96; line drawings and mathematical tables. 7.5 reichmarks, in Germany.

BERECHNUNG VON BEHÄLTERN NACH NEUEREN ANALYTISCHEN UND GRAPHISCHEN METHODEN: Für Studierende und Ingenieure und zum Gebrauche im Konstruktionsburo. Zweite, vollständig umgearbeitete und erweiterte Auflage mit Benutzung der gemeinsam mit Prof. Dr. K. v. Terzaghi bearbeiteten ersten Auflage—Von Dr. Theodor Poschl, o.o. Professor an der Deutschen Technischen Hochschule in Prag. Berlin: Julius Springer. Cloth; 6x9 in.; pp. 212; 71 line drawings; mathematical tables. 15.6 reichmarks, in Germany.

HYDRAULICS—By Joseph N. Le Conte, Professor of Engineering Mechanics, University of California. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 348; 191 line cuts. $3.

LABORATORIUMSARBEIT IN DEINSTE DER AUSBILDUNG DER BAUINGENIEURE ARCHITEKTEN—Von E. Probst und A. Hummel, Karlsruhe, i. B. Karlsruhe: reprinted from *Zement*, 1926. Paper; 5x8 in.; pp. 13; line cuts and tables.

TRANSPORT AVIATION—By Archibald Black, Consulting Air Transport Engineer, formerly Consulting Engineer, U. S. Air Mail Service, Chairman (1925) Aeronautic Division, A.S.M.E.; M. A.S.M.E., M. Soc. Automotive Engrs., M. National Aeronautic Assoc., M. National Aeronautical Safety Code Committee. New York: Simmons-Boardman Publishing Co. Cloth; 6x9 in.; pp. 245; 107 halftones and line cuts; 26 tables. $3.

Letters to the Editor

A FORUM FOR DISCUSSION OF VIEWS OF ENGINEERS AND CONTRACTORS

Sulphur Treated Concrete

Sir—Referring to the article on "Strengthening and Indurating Concrete with Sulphur" by W. H. Kobbé in your issue of June 10, 1926, p. 940, I also have used sulphur for the purpose of strengthening light-weight concrete for experimental purposes. It should be noted, however, that the increased strength in concrete which is treated with sulphur obtains only as long as this treated concrete is not heated above the melting point of sulphur. If the temperature of this concrete is raised above this point (113 deg. C.) the strength drops back to approximately the same as it was before the treatment. The same principle applies to the compressive strength. It would therefore not be advisable to figure with this increased strength for structural purposes where there is danger from fire.

Another point to be considered in the use of sulphur is that in concrete which is reinforced, the steel reinforcement may deteriorate very quickly if air or moisture or both reach the steel. The air and the moisture will combine with the sulphur to form sulphuric acid which will make the steel rust very rapidly. It is true that the water absorption in sulphur-treated concrete is very much smaller than in ordinary concrete but air and moisture are always liable to reach the steel through cracks or in places where the steel is not sufficiently protected.

The use of sulphur as a binder for materials in the manufacture of molded fittings proved disastrous about ten years ago to a company in England. The embedded metallic parts in these fittings were attacked by acids resulting from oxidation of the sulphur, and the molded pieces lasted only a short time. The same thing has happened to metallic parts embedded in hard rubber which contains more than a certain amount of sulphur. ERNEST WALTER.

Montclair, N. J.,
June 29, 1926.

Water Power—The Esthetic vs. the Practical

Sir—The editorial, "Using Nature Best" in your June 17 issue seems to the writer to contain much that borders on the vindictive and to lack constructive suggestions.

I did not hear Mr. Merrill, and yet I feel safe in saying that the so-called "nature lover" and the developer of hydro-electric power are not so far apart. This should not be taken to mean that I feel that it is yet time for the lion and the lamb to lie down together. I do feel, however, that it is just as important that the power developer recognize that the outstanding scenic features of this country must be saved from destruction, even though such salvation adds to our burden of living costs, as it is for the park booster to become reconciled to giving up minor features to developments which otherwise serve mankind.

A case now pending should explain the point: I understand that the building of a proposed hydro-electric plant in Kentucky will destroy Cumberland Falls, which ranks second to Niagara Falls of days gone by as a scenic spectacle, and that it is quite possible without greatly varied conditions or greatly increased costs to develop more power lower down on the same river without injuring the valuable natural features. Is there any reason to condone destruction of these falls if these statements are facts? Or is there any reason to permit destruction of a feature that man cannot duplicate?

To view this situation from the proper standpoint, one must consider a virgin country on which we have only a life lease and find ourselves in need of a tremendous volume of energy. Is it true economy to destroy something that cannot be replaced in order to make the investment of a few more productive and to make life for a greater number, through cheaper power, more wholesome or should we not attempt to safeguard the outstanding scenic areas of this country that other generations may have something of the natural beauty that is ours today by priority? I cannot believe that there is any real conflict. There are places, many of them, where dams can and will add something to the value of the natural scenery and there are others which can only be destroyed by such construction.

Granting that scenery has value, is there doubt that any of the man-made structures in the world today could not be duplicated more easily and at less expense than any of the scenic wonders that the "nature lovers" continue to struggle for, or that the position of these men is not fairly founded upon much more than a desire to view all things from the esthetic side?

The reason for the constant defense of this country's scenic assets against obliteration is found in an appreciation of the economic use of land. There is a place for everything and everything has its place. And it is with this idea—which as I know it, has not been widely expressed—that the "nature lovers" will continue to do battle for the preservation of the scenic features of America, knowing that their work is practical even though the result does appeal to the less tangible elements of life. H. S. WAGNER,

Akron, Ohio, Director-Secretary, Metropolitan Park
June 25, 1926. Board of Summit County.

Road Maintenance Costs Criticised

Sir—An interesting article on "Ten Years of Road Maintenance Costs in New York State" is given in *Engineering News-Record*, June 17, p. 979.

Maintenance cost figures very often have little economic value because the cost compilations do not give due weight to the comparative age of the pavements cited, the comparative initial cost and the comparative traffic on them.

In this particular article no reference is made to the average ages of the respective classes of pavements cited. From a study of official records I gather that the average age of the bituminous macadam pavements at the beginning of 1925 was 9.1 years, while the average age of the first-class portland cement pavements was only 3.5 years on that date. Official reports of the Highway Department show that 2,624 miles of bituminous macadam were constructed prior to 1916. I have not the exact figures of the first-class concrete constructed prior to that date. but the mileage must have been small as that type was practically all constructed in 1914 and subsequent years. It is manifestly unsound to compare the maintenance costs on the old bituminous macadam with the maintenance costs on the comparatively new portland cement concrete and reach any conclusion as to relative economy on such a basis.

Moreover, the first cost of thousands of miles of the bituminous macadam was from a half to a third the first cost of the so-called first class concrete roads, and if interest be taken into account, an entirely different showing would result. J. E. PENNYBACKER,

New York, N. Y., General Manager, The Asphalt
June 22, 1926. Association.

Textbooks on Construction

Sir—The editorial in *Engineering News-Record*, June 17, 1926, p. 968, entitled "Construction Textbooks Needed" is noted with interest. It is indeed unfortunate that there are so few available books covering construction technique, especially when it is remembered that construction is the ultimate object of all preliminary studies and designs.

Students of composition have not completed their courses when they have learned the parts of speech, definition of words and rules of punctuation. They must proceed to the acquisition of the technique of constructing smooth readable subject matter. So in our engineering training it is not enough to teach methods of design and investigation; such knowledge is valueless without at least some fundamental ideas of transforming the designs into finished useful structures.

About a year ago the Miami Conservancy District published the last of its series of technical reports—this one entitled "Construction Plant, Methods and Costs," and written by Charles H. Paul. *Engineering News-Record* and other technical journals commented editorially on the particular value of this report to engineers engaged in construction work and noted especially its complete treatment of construction methods as developed on the Miami Valley flood control project. More books of this type are needed.

Dayton, Ohio, C. S. BENNETT,
July 9, 1926. Civil Engineer.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Way Paved for Agreement on St. Lawrence Power

New York and Ontario Commissions Meet—A Complication in Rights Develops

Noteworthy advances toward the development of hydro-electric energy on the St. Lawrence River were made at a series of conferences held in Toronto, Canada, on July 7 and 9 between representatives of the State of New York and the Ontario Hydro Electric Power Commission.

The application and plans which have been filed with the New York State Water Power Commission covering both single and two-stage developments on the St. Lawrence River were discussed in detail. It was agreed that all plans and estimates of cost covering all suggested developments presented to the New York State Water Power Commission would be left with the Ontario Hydro Commission for further examination and a conference is to be held in two weeks time to further discuss the plans proposed.

The engineers of the Ontario Hydro Commission offered to supply the representatives of the New York State Water Power Commission with the data which they have obtained on the situation.

PROMPT ACTION NEEDED

Premier Howard Ferguson of Ontario, in an address at the opening of the conferences emphasized the fact that the results of the meetings would not only do much to hasten power development but to promote good feeling between the United States and Canada. The early discussions had demonstrated that there was a determination on the part of both parties to reach common ground on the broad principles of the development of international waters. "We both recognize that expedition is the very essence of the problem," he said, "and we realize as well that by our co-operation we can accelerate the whole movement and remove the possibility of friction and difficulty that might otherwise arise."

The New York State delegation consisted of Roy G. Finch, state engineer; Albert Ottinger, attorney general; Joseph A. McGinnies, speaker of the assembly; Randall Laboeuf, deputy attorney general; F. Williams, secretary to the commission; Judge Ferris, counsel for the commission, and John P. Newton, assistant state engineer.

Ontario Hydro Commission was represented by C. A. Magrath, chairman, J. R. Cooke, C. Alfred Maguire, F. A. Gaby, chief engineer, T. H. Hogg, hydraulic engineer, and Arthur W. White, consulting engineer.

Premier G. Howard Ferguson of Ontario presided at the conference.

An unrepealed act of the legislature of New York State passed in 1850 apparently giving a grant in perpetuity for the construction of a dam across the St. Lawrence River, which may further complicate the St. Lawrence power development situation, has come to light at Albany.

The legislature that year passed Chapter 165 of the laws of 1850, reading as follows:

> Henry Van Rensselaer of Ogdensburg, St. Lawrence County, his heirs and assigns, are hereby authorized to erect, for hydraulic purposes, a dam across that channel of the river St. Lawrence lying between the main shore in the town of Lisbon, in the county of St. Lawrence, from the lands of said Van Rensselaer on said main shore, to Galloup Island, in said river, and to maintain and continue said dam for such purposes. But this act shall not authorize said Van Rensselaer, his heirs or assigns, to flow or otherwise injure lands of other persons.

The location of the dam authorized by the act of 1850 is four miles below Ogdenburg and about 30 miles up stream from Barnhart Island at which point the present applicants to the New York State Water Power Commission contemplate the erection of dams. A search of the statutory records show that the law has never been repealed.

Engineering Fifty Years Ago

From *Engineering News*, July, 1876

THE last brick is laid in the Hoosac Tunnel. The State Railway Officials have ordered steel rails for the whole distance between Greenfield and Bradwell's Ferry. Arrangements have been made for the running of through trains from Boston to Troy, Albany and Saratoga.

* * *

We gather from the official report of the St. Gothard Tunnel that the monthly progress at the northern end is 380 ft.; and at the southern end, 200 ft. 20,000 ft. are completed, about 10,000 ft. at each end; 50,000 ft. remain and at the present rate of progress (about 600 ft. per month) the tunnel will be completed in about seven years.

Big Terminal Warehouse for Port of Montreal

A cold storage plant and terminal warehouse, ten stories high and with a floor space of 600,000 sq.ft. will shortly be erected in Montreal, Canada, by the Montreal Rail and Harbor Terminals, Limited, at a cost of about $5,000,000. The erection of the plant will be financed by the Municipal Bankers' Corporation of Toronto, which is now financing the construction of a similar plant in Toronto.

Protective Works Neglected in Flood Area

Damage to Mexican Town From Flood Due to Restrictions in the River Channel

Report by I. C. McBride of the Guanajuato Power & Electric Co., Guanajuato, Mexico

Regarding the flood at Leon, State of Guanajuato, Mexico. Information furnished by the representative of the Guanajuato Power & Electric Co. at that place is to the effect that the flood was not caused by the breaking of a dam. After a three day rain at a moderate rate a heavy downpour, perhaps a cloudburst, in the middle of the night brought the first rise over the banks of the stream. About two hours later an additional quantity of water reached the town from an arroyo along which there were a number of small farmers' reservoirs that usually are found to be two or less meters in height. These are earth dykes with no spillway. The main flood broke across to fill these and they went out at the time of the second rise.

Leon is on a dry arroyo called "de los Gomez." The channel has been allowed to fill with dumping from refuse as well as the deposition of stream wash. Banks one or two meters high have been built along its course through the town. These have not been repaired for years although former floods are on record. The adjacent lands have been occupied by the growing population. The foundation of buildings being in some cases below the river bed. The lower areas were inundated to two and three meters in depth.

The outlet of the river beyond the town is very flat. There are two bridges in the part opposite the business section which have a very limited opening. This was no doubt a part of the reason for the backwater as well as the filled-in channel.

Many of the houses are of adobe. These melt like sugar when exposed to standing water for a short time. To date eighty victims have been recovered. The total list is thought to be one hundred or more.

Merger of City and County of St. Louis, Mo., Proposed

A proposed merger of the City of St. Louis and the County of St. Louis, Mo., is to go to popular vote on Oct. 26. After a long deadlock over bringing the plan to a vote, in which the city members were for and the county members against an election, one of the nine county members signed the election order, although against consolidation, in order to let the voters settle the matter. This was done on the eve of the expiration of the terms of the members of the board.

WASHINGTON NOTES

MUCH significance is attached to the Treasury Department's analysis of the two principal bids for Muscle Shoals and their comparison with the bid submitted previously by Henry Ford. By this impartial study an example is set which is likely to be followed frequently by committees of Congress in the future.

Had the trained actuaries of the Treasury Department analyzed the Ford bid and the other offers that have been made for the government's Muscle Shoals properties, many of the wild claims made by members of Congress could have been refuted immediately.

The Treasury Department's financial analysis of the various offers is summarized as follows:

DAM NO. 2, DAM NO. 3, AND STEAM PLANT, ALL FULLY EQUIPPED

	Associated Power Cos.	Air Nitrates Corporation	Henry Ford
I. Without Headwater Storage			
Present worth of future payments	$54,627,610	$45,832,283	$45,986,482
Interest return to U. S. on its total investment of $80,772,341, per cent	3.252	2.828	2.798
II. With Headwater Storage			
Present worth of future payments	$78,695,930	$45,832,283*	$45,986,482*
Interest return to U. S. on its total investment of $80,772,341. per cent	4.432	2.828	2.798

*The offers of the Air Nitrates Corporation and Henry Ford do not provide for any increased return to the United States for headwater storage.

Certain interesting facts develop from this analysis:

The offer of the Air Nitrates Corp. returns but 2.828 per cent on the investment of the United States, and not 4 per cent as has been the common understanding. The offer is worded so that a reader is lead to believe it provides 4 per cent interest return to the U. S. on its investment. But, the bidder stipulates that this is to apply to the expenditures made by the U. S. reduced by all amounts expended prior to May 31, 1922, or $20,738,404. That is, bidder asks deduction of 4.17 per cent of the total of $49,734,335 expended by the United States up to date. The offer as worded creates the impression that in addition to 4 per cent interest return a fund will be created to pay back to the United States the total investment within one hundred years. The Treasury analysis clearly shows that only 2.828 per cent interest will be received on the investment, and that no money would be available to repay any of the principal.

The Ford offer on a 50-year basis returns 2.798 per cent, whereas the Air nitrates offer returns 2.828 per cent.

The Associated Power Companies offer returns 3.252 per cent interest on the total investment, if no headwater storage is constructed; and 4.432 per cent interest if headwater storage is constructed in 10 years. This offer, if headwater storage is constructed in ten years, will return 4 per cent interest to the United States on the yearly balances of the total investment, and in addition repay to the United States $66,015,946 or 81.7 per cent of the initial investment. This is within the fifty year lease period, at the end of which time the United States will also have returned to its possession the entire power properties.

Civil Engineers Board Meets at Seattle

Principal Business Is Action on Professional Practice and Aid to Research

(Engineering News-Record Staff Report)

Fifteen members of the Board of Direction of the American Society of Civil Engineers met at Seattle July 12 and 13 prior to the summer meeting of the society. Outside of routine business the most important action was voting of financial support to several research activities and decisions on two important matters of professional conduct.

The board endorsed activities of the committee of the Society for Promotion of Engineering Education under the auspices of the Carnegie Foundation in studying the subject of engineering education and voted to contribute financially to its support. It also authorized the appropriation of sufficient funds to provide for immediate needs of the Stevenson Creek Test Dam Investigation and voted funds for use of the society's Committee on Effects of Earthquake on Engineering Structures to be used in the study of vibration periods of buildings.

Professional Matters

Action on the two professional matters is expressed in the following two statements given out by the board. The first is a report of the society's Committee on Professional Conduct signed by Messrs. Grunsky, Hammond and Webster and approved by the board. It reads as follows:

"On a statement of facts as below noted your Committee on Professional Conduct submits its conclusions as below noted. A Governor is charged with having appropriated to his own use interest on state funds which it is claimed rightfully belonged to the state. This was done prior to his having become Governor, while serving the state in the capacity of state treasurer. In converting to his own use the interest allowed by the banks on money deposited by the state treasurer, he was, it is understood, following precedent. It appears to have been an established practice of the treasurer to regard all interest earned as a perquisite belonging to the incumbent of the office. The amount involved is large, possibly more than a million dollars.

"The matter having been taken into the courts it was determined that the money had been wrongfully taken and must be returned to the state. The decision of the lower court in this matter has been sustained by the supreme court of the state.

"In these circumstances the Governor sent out an appeal to those in the service of the state to contribute to a so-called defense fund. It is not known in what form this appeal was made. However, it has reached the engineer employees of the State Highway Department with the suggestion that contributions would be acceptable. Directly or indirectly it has been intimated that a fair contribution would be a month's salary or half a month's salary as the case may be. The party to whom payments of these voluntary contributions are to be made is the personnel officer of the department. The announcement that such contributions to the defense fund are desired was made by an engineer, a member of the American Society of Civil Engineers holding high rank in the engineering staff of the department.

"Having given these facts consideration the committee hold that solicitation of funds or any suggestion that money should be contributed for such a personal or political purpose, coming from the head of the department was wrong and reprehensible. No such request could be presented from above, even though couched in terms to make contributions appear voluntary, without carrying with it an implied threat.

"The committee recommends there that all members of the profession who have thus been solicited ignore the request, and it takes this occasion to condemn such practices most emphatically. If it should happen that failure to respond to the request for contributions results in discharge or other unfair treatment of members of this society then suitable action should be taken for redress, with assurance that this society will give such support as circumstances permit. The committee further recommends that its findings in this matter be given publicity in the proceedings."

Although not so stated by the board this report obviously refers to the so-called Len Small defense fund campaign in Illinois.

Action in St. Louis Case

The second action is expressed in the following statement: "The Board of Direction of the American Society of Civil Engineers at its meeting on July 13, 1926, considered the request submitted last April for the expulsion for cause set forth of Messrs. Edmund R. Kinsey and R. B. Brooks, members of the society, and voted that these members be not expelled from membership in the society." The charges against E. R. Kinsey and R. B. Brooks were that as members of the Board of Public Service of St. Louis, of which E. E. Wall, the Director of Public Service was also a member, they met with all the members except Mr. Wall and agreed to recommend his removal.

In other matters the board authorized technical division executive committees to draw mileage for necessary meetings at the time of society meetings. It anounced that the 57th Street property has been leased for a long term at rental considerably in excess of that at present enjoyed. Three new student chapters were authorized.

$141,000,000 for Subways in Two Years

New York's Board of Transportation Has Let Many Contracts Since Its Organization

The Board of Transportation of the City of New York which entered upon its third year on July 1, has, in the two years of its existence, awarded in contracts for all rapid transit purposes a total of $141,041,340, subdivided as follows:

1924, Six months	$27,000,000
1925, twelve months	84,659,691
1926, six months	29,381,659
Total awards	$141,041,340

Of this amount, the awards for the construction of twenty-two contracts or sections of the west side route of the City's new independent subway system, amounted to $94,605,157. For five contracts for a like amount of sections of construction to the 14th Street-Eastern subway in Brooklyn, the awards totaled $13,178,497. The balance was divided between contracts for additional construction and improvements to existing structures under contract between the city and the Interborough Rapid Transit Company and the New York Rapid Transit Corporation (B.M.T. System), such as the Flushing Extension, the Queensboro Extension under 42nd St. to 8th Avenue.

Within the next few months, according to plans which have been prepared by the board, at least $70,000,000 in awards will be made for additional construction to the city's new subway system, under 53rd St. from 8th Ave. to Queens Plaza in Long Island City, along 6th Ave. extension from Greenwich Village via Canal, Church, and Fulton St. and then under the East River to Brooklyn.

For the six months ended June 30, 1926, the Board of Transportation awarded in contracts for all rapid transit purposes, a total of $29,381,660 and disbursed for rapid transit construction, a total of $19,906,788.

The awards of contracts for six months are subdivided as follows:

City's new subway system	$23,435,236
B. M. T. System	4,932,947
I. R. T. System	741,710
Miscellaneous	271,766
Total for 1926	$29,381,659

During the six months the contracts awarded for the construction of the city's new subway system amounted to $23,435,236, of which $46,933 was for surveys and borings, and $23,388,303 was for five contracts for an equal number of sections of new subway as follows:

8th Ave., Bank to 18th St.	$4,160,322
8th Ave., 18th to 28th St.	5,258,000
8th Ave., 48th to 58th St.	6,840,000
St. Nich. Ave., 141st to 149th St.	4,710,000
St. Nich. Ave., 141st to 149th St. (Steel)	452,340
Ft. Washington Ave., 183rd St to Overlook Terrace	1,967,641
	$23,388,303

Awards of contracts made under Contract No. 4 with the New York Rapid Transit Corporation (B.M.T. System) amounted to $4,932,947.33, of which $3,869,458 was for the construction of two additional Brooklyn sections of the 14th Street-Eastern subway. One of these is along Wyckoff Avenue from Halsey Street to Cooper Avenue, and the other under private property from Cooper Avenue to Stewart Street, leaving only one section to be awarded.

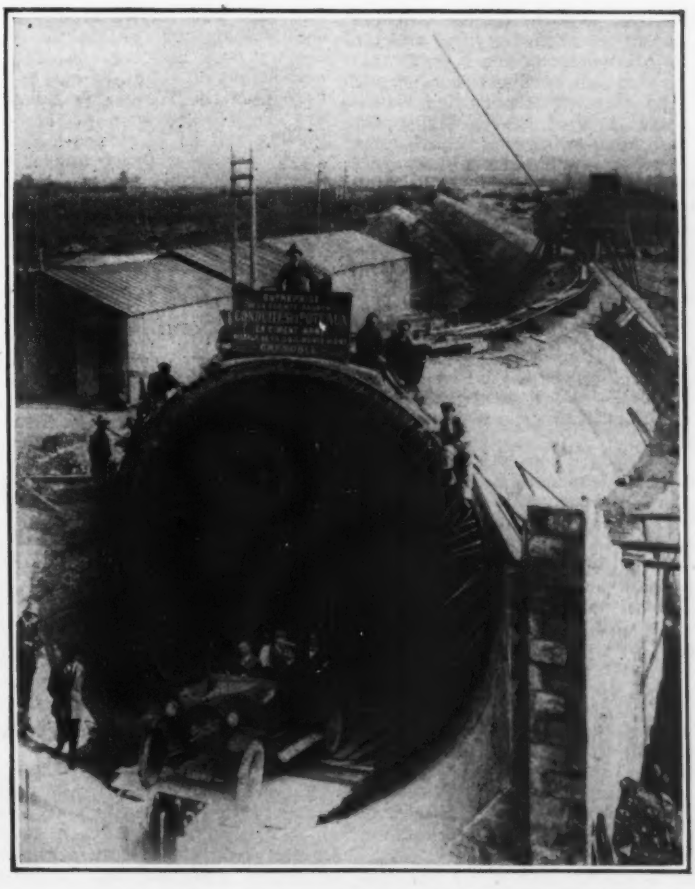
Charter of Southern New England Railroad Expires

The charter of the Southern New England Railroad Co., the ambitious project of the former Grand Trunk Ry. to connect Montreal with the port of Providence, R. I., expired at midnight July 7. Construction of the railroad was started before the World War, the company bought a right-of-way, did much of the grading, including many cuts and fills, and built trestles and the abutments of bridges. When the war came on work was stopped after approximately $7,000,000 had been spent on the project. Later the subsidiary company, unable to get support from the parent company or to meet payments on property which it had purchased, went into bankrupcy. It was hoped for a time that the railroad would be completed; but the Grand Trunk, now a part of the Canadian National Railways was in no position financially to undertake the work, nor was the project looked upon with favor as a national undertaking in Canada due to the prospect of diverting traffic from Canadian ports, and no private capital would undertake the work. As a result the Governor of Rhode Island refused to call a special session of the legislature to extend the charter.

Certain commercial interests in Rhode Island still hope that the property may be bought by one of the larger eastern railroads in the United States when it is put up for sale.

New Pier Structures for Port of Galveston, Texas

The Galveston Wharf Co. has applied to the Interstate Commerce Commission for authority to issue $1,250,000 worth of bonds, $1,000,000 of which is to be used to retire existing bonds and the remainder for the purpose of constructing new piers, bulkheads, sheds, warehouses, and other structures, in part to replace those destroyed by fire January, 1926.



SIX-METER DIAMETER CONCRETE CONDUIT

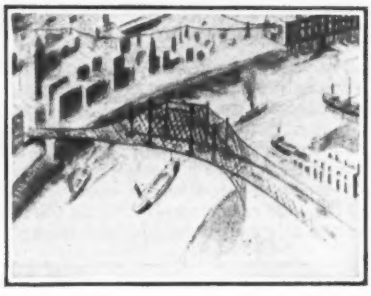
The reinforced-concrete conduit shown above is being built at a power station near Grenoble in the French Alps. It is 6 meters in diameter and 1,456 m. long, made up of two sections of straight conduit connected by a section curved to a radius of 200 m.

RANDOM LINES

Spread Net Suspension!

Sir—If you have not already done so, please add to your collection of Artist's Bridges the structure shown on page 29, May 22 issue, of your associate, *Electrical World.*

At first glance, it appeared that an error had been made and that the cut had been intended to accompany an advertisement for Cyclone Fencing, but a closer scrutiny fails to bear out this conclusion. Moving the portals



well out toward the center will unquestionably shorten the span, and the scheme of supporting the main towers directly on the bridge floor should prove popular where restricted waterways are involved. Also, laying out the main span on a curve should effect considerable saving to the taxpayers in locations where valuable land would have to be acquired to provide approaches for a straight span. All things considered, this design represents a distinct advance in the art.

H. M. W.

* * *

Bascule Basculorum

The annual report of the Florida East Coast Ry. says as follows regarding the new St. John's River bridge at Jacksonville.

"This structure represents one of the outstanding engineering feats of the year and is a structure indicative of the most modern thought in both design and construction. It is claimed that the Bascule span in this structure is of the heaviest type ever constructed."

The last sentence is amphibious and intriguing with its use of the word type.

* * *

Professional Engineers?

"Chicago, June 30.—A 'white collar' strike, the first among professional engineering employees of the city, today tied up approximately $4,000,000 in bridge construction and promised to affect a total of $10,000,000 in building projects. . . .

"The engineers seek a 30 per cent wage increase, the scale now ranging from $160 to $650 a month.

"The incinerator, or garbage reduction plant employees ask $7 instead of $5.75 a day."

Are these latter "engineers" applicants for places in our roster?

Williams Named Engineering Dean at Iowa University

Prof. C. C. Williams, head of the civil engineering department of the University of Illinois, has been named dean of the College of Applied Science at the State University of Iowa, Iowa City, to succeed the late William G. Raymond. Prof. Williams is a graduate of the University of Illinois in the class of 1907. Previous to graduation he was employed on railroad survey work and after graduation was in the civil engineering department at the University of Colorado for seven years. In 1914 Prof. Williams went to the University of Kansas as professor of railway engineering, and in 1922 went to the University of Illinois as head of the civil engineering department. Prof. Williams has practiced civil engineering extensively in conjunction with his teaching.

873-Ft. Office Building Proposed for Detroit, Mich.

It has been announced by J. B. Book, Jr., of Detroit, that he will construct an 81-story building on a plot of ground fronting on State St. in Detroit and running back 120 ft. on Washington Boulevard and 180 ft. on Park Place. The building will adjoin the present 39-story Book Building. It will have a total height of 873 ft. or nearly 100 ft. more than the Woolworth Building in New York. The main portion of the building will be 42 stories high, above which will be a tower approximately 120x125 ft., diminishing slightly in plan in the upper stories.

Plans are being prepared but no contract for the construction has been let.

Bids Opened for Borings for Champlain Bridge Sites

The state engineer of New York, on July 7, opened bids for the borings to be taken at five possible sites for the proposed bridge across Lake Champlain between New York State and Vermont. The five proposed sites are as follows: (1) From Fort Frederick, N. Y. to Chimney Point, Vt. (2) From north of Putnam Creek in Essex County, N. Y. near Crown Point to near West Bridport, Vt. (3) From Fort Ticonderoga, N. Y. to Larabee Point, Vt. (4) From the Old Fort at Ticonderoga, N. Y. to Mount Independence, Vt. (5) From Wright, Washington County, N. Y., to Chipman's Point, Vt.

Engineer Named in St. Louis Water Department

Following the farcical trial and removal of Edward E. Wall as director of public utilities in St. Louis, Mo., several weeks ago and the appointment of Water Commissioner Pritchard to succeed him the position of water commissioner was left vacant. Now Mayor Miller has announced that he will appoint Leonard A. Day, an hydraulic engineer in the Water Department since 1903, to the position of water commissioner in the Water Division.

St. Louis Engineers Acquire Residence for Club House

The Engineers Club of St. Louis and the Associated Engineering Societies of St Louis, with a combined membership of about 600, have just obtained title to a large stone residence on Lindell Boulevard and are now remodeling the structure with the idea of taking actual possession about the first of October. The amount paid for the property is $32,500. About $12,000 additional will be spent on remodeling and decorating.

The acquisition of this property is the culmination of a movement started in that city several years ago for an engineers' building. An investment structure was first considered, and tentative plans were drawn up for an office building, with space reserved for club rooms, which would have involved a total investment of about $1,000,000. Opposition developed because of the magnitude of the undertaking, and the possibility that such a project would later lead to financial difficulties. A similar plan was then prepared for a smaller investment project, which would have called for a total expenditure of about $400,000. This plan was likewise discarded in favor of the one recently brought to a successful conclusion.

In laying their plans for the acquisition of the Lindell Boulevard property it was decided to make no attempt to raise the funds through sale of bonds or stock, which might in the end have little intrinsic value, but to make a direct appeal for cash donations from engineers and industrial concerns allied with engineering activities. A large committee was appointed to raise the money. The active subscription campaign was started immediately after the first of January, 1926. Within ten weeks a total of $46,000 had been subscribed.

Banking House Seeks to Aid Utilities in Financing

An innovation in the usual practice of banking houses in relation to the financing of public utilities and industrial concerns has been inaugurated this week by the investment house of Hornblower & Weeks. In the past it has been the custom for public utilities and other commercial organizations when undertaking new financing to seek out an investment house which will purchase the securities. Now the order has been reversed by the firm of Hornblower & Weeks. This company has begun a campaign to seek out utilities, commercial and industrial organizations who are planning to do financing by advertising its facilities in technical and trade journals, facilities which include a bond department which buys and sells all issues of bonds and notes of the United States and foreign governments, municipalities, railroad companies, equipment trusts, public utilities, and industrial corporations, a statistical department, an underwriting department, a stock and note department, and an expert engineering division to assist in the preparation of reports and appraisals.

Civil Service Examinations

UNITED STATES

For the following civil service examinations apply to the United States Civil Service Commission, Washington, D. C., or to any local office of the commission.

Concrete Engineer, Materials Engineer, Ceramic Engineer, Assistant Chemical Engineer—Vacancies to be filled in the United States Bureau of Standards at Washington and in the Forest Products Laboratory (pulp and paper section), Madison, Wis., and similar positions; salaries for engineers, $3,800, and for assistant engineer, $2,400; education, training, experience and writings to be considered in examination. Applications for these positions will be received to July 27.

Transitman—For service in the General Land Office, salary $1,860. Application may be made to Aug. 7.

Associate Architect, and Assistant Architect—For service in the Supervising Architect's Office, Treasury Department, Washington; respective salaries $3,000 and $2,400. Application period is to Sept. 30.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, N. Y.; Summer Meeting, Seattle, Wash., July 14-16; Annual Convention, Philadelphia, Pa., October 4-9, 1926.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Providence, R. I., Sept. 14-17, 1926.

INTERNATIONAL CITY MANAGERS' ASSOCIATION, Lawrence, Kansas; Annual Convention, Colorado Springs, Colo., Sept. 21-23, 1926.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.; Annual Convention, Pinehurst,, N. C., Nov. 8-12, 1926.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Louis, Mo.; Annual Meeting, Washington, D. C., Nov. 8-12, 1926.

THE ASPHALT ASSOCIATION, New York City; Annual Meeting, Washington, D. C., Nov. 8-12, 1926.

The Engineers' Society of Cleveland, Ohio, gave to Willard Beahan, retired consulting engineer of Cleveland Heights, an honorary life membership, at its annual dinner meeting June 14, in recognition of his pioneer work in railway location and construction and his high standing in the engineering profession. The society elected as its officers for the coming year: President, Wendell P. Brown, consulting engineer and president of the company of his name; vice-president, J. V. Emmons; treasurer, Dudley H. Scott.

The Michigan Engineering Conference, sponsored by 23 societies, has been put on a stable annual basis following the success of the first meeting early in February. Plans are announced for next year's meeting Feb. 3 and 4 in Detroit with L. E. Williams, chairman, and E. L. Brandt, secretary, who is secretary of the Detroit Engineering Society.

The St. Louis (Mo.) Engineers' Club held its annual meeting and election of officers June 15. Dr. D. S. Kimball, dean of the College of Engineering at Cornell University and president of American Engineering Council, gave an address on the benefits business and industry have gained from engineering progress. The society's new officers are: J. D. Robertson, president; W. W. Horner and A. S. Hawks, vice-presidents; W. O. Pennell, treasurer; and C. W. Sammelman, secretary.

Personal Notes

BURTON LOWTHER, until recently chief engineer of the Denver municipal water-works, has opened an office as consulting engineer in the Guardian Trust Bldg., Denver, Colo. He proposes to handle the design and management of water-works, filtration plants, sewage systems and also the design and management of power plants, earth and masonry dams, as well as to make chemical and bacteriological reports. Mr. Lowther has been acting chief engineer and chief engineer of the Denver water-works since a short time before it was taken over by the municipality from the Denver Union Water Co. in 1918. Previous to that time he was construction engineer of the Works Department of Kansas City, Mo., and from 1913 until he went to Denver was chief engineer.

MAJOR P. B. FLEMING, who has been serving in Washington as chief of the Finance Division of the office of the Chief of Engineers, has been placed in command of the engineer detachment at West Point.

S. G. WHITTELSEY, former city engineer of Chico, Calif., announces that he has taken over the engineering office, in San Francisco, of C. C. Cottrell, who is now Manager of the Highways Bureau of the California State Automobile Association. Mr. Whittelsey since opening an engineering office in San Diego in 1909 has been engaged in various engineering projects in California; his most recent connections have been as consulting engineer for Colusa County, and as acting city engineer of Chico, for the past year.

ROBERT TRIMBLE, at present assistant chief engineer of the Pennsylvania R.R., with headquarters at Pittsburgh, has been appointed chief engineer of the Pennsylvania Co. and the Pittsburgh Cincinnati, Chicago & St. Louis R.R. Mr. Trimble has been in the service 51 years and is still on active duty.

JAMES G. O'KEEFFE, who has been engineer of construction for the Public Service Electric & Gas Co., at Newark, N. J., has been appointed general superintendent of manufacture. FREDERICK A. LYDECKER is made general superintendent of distribution, having been until the present time assistant general superintendent of distribution, which position is now assumed by HARRY ELLIS, until now distribution engineer for the Southern Division. WILLIAM H. CHADWELL, formerly superintendent of the Front Street Gas Works, is now attached to the drafting department and becomes assistant construction engineer.

A. C. E. MULLEN, assistant engineer of construction of the New York, New Haven & Hartford R.R., has been promoted to construction engineer, with headquarters in New York City. C. T. LYON is appointed construction engineer with headquarters at New Haven, Conn., taking the place of A. T. CURTIS who has gone into private business. H. E. BRINK, formerly assistant engineer in the office of the chief engineer of the road, has been given an appointment as a general assistant engineer, with headquarters at New Haven; he had charge of the construction of the railroad bridge over the Thames River at New London, Conn.

MAJOR ROGER G. POWELL, Corps of Engineers, who has been in charge of the district at Providence, R. I., is transferred to the district at Cincinnati, Ohio, and will have charge of the Ohio River improvement works in that district. The Providence district will be under the charge of MAJOR RAYMOND F. FOWLER, who has been instructor in command at the general staff school at Fort Leavenworth. MAJOR K. B. LYMAN, recently district engineer at Cincinnati, has been ordered to Washington for duty in the office of the chief of Engineers.

Obituary

JOHN OVERN, general manager of the Dominion Engineering Works, at Lachine in the Province of Quebec, died July 2 at Philadelphia, Pa., at the age of 58 years. Mr. Overn was for a number of years manager of the I. P. Morris department of William Cramp & Sons, in Philadelphia, and during recent years in Canada was well known in hydro-electric work.

CLARENCE S. GALE, Raleigh, N. C., who served as engineer in highway construction in Maryland, Delaware and North Carolina, died recently after an operation, aged 45 years. For the past two years Mr. Gale had been in highway contracting in Raleigh, with Hayes-Barton. In 1919 he had been a representative of the Portland Cement Association in the southeastern states; in highway work he had been in the past few years construction engineer for the Delaware State Highway Department, and had served on road construction work in Maryland for Fisher and Carrozi of Baltimore and in Delaware for the Highway Engineering Construction Co.

Construction Equipment and Materials

A SECTION DEVOTED TO WHAT THE MANUFACTURER IS DOING FOR THE ENGINEER AND CONTRACTOR

United States Trade with Latin America in 1925

American exporters who are doing business in Latin America or who contemplate entering this field will find information of considerable value to them in a trade report on this region published by the Department of Commerce.

Latin America is a constantly growing market for American products. Each succeeding year shows an advance over the one preceding. In 1925 the value of American exports to all Latin American countries was more than $880,000,000, an increase of more than 14½ per cent over 1924. In all of the South American republics the proportion of goods imported from this country is steadily increasing, while that of our competitors is falling. A few of the percentage figures will suffice to show the gains United States exports have made since the war. In 1913 our share of Colombia's trade was about 27 per cent; today it is around 50. In Venezuela we have increased our ratio from 38½ to 55½ per cent; in Brazil from 15.7 to 24.2; in Argentina from 14.5 to 23; and in Bolivia from 7.4 to 28.

"United States Trade with Latin America" is published in two sections, the first of which is now available. The second will appear at an early date. Part I—Northern Latin America appears as trade information bulletin No. 418. Copies may be obtained from any district or co-operative office of the Bureau of Foreign and Domestic Commerce, or copies may be secured direct from the Superintendent of Documents, Government Printing Office, Washington. The price of each bulletin is 10 cents.

Business Notes

THEW SHOVEL CO., Lorain, Ohio, has appointed two new distributors, the North State Culvert Machinery Co., Asheville, N. C., for eastern North Carolina, and the Fred C. Crane Co., 1301 So. Lamar St., Dallas, Tex., for central Texas.

JEFFREY MFG. CO., Columbus, Ohio, announces the election of Robert W. Gillispie as vice-president, assistant general manager, and member of the board of directors. Mr. Gillispie has for many years been identified with the Bethlehem Steel Co. in executive sales work.

PIERCE-ARROW MOTOR CAR CO., Buffalo, N. Y., has been awarded an order for 75 trucks by the City of New York. This fleet will be used by the department of street cleaning and will be equipped with dump bodies for the collection of garbage and dirt in the summer time and for snow disposal in the winter time. Fifty-three of the trucks are of 7½ ton capacity and 22 of 5 ton capacity. Delivery of these 75 trucks will make a total of 318 dual-valve Pierce-Arrow trucks purchased by the City of New York.

SUPERIOR STEEL PIPE CO., a new corporation with offices at 2111 Farmers Bank Building, Pittsburgh, Pa., has acquired the works of the former Memphis Steel Construction Co., Greensburg, Pa. Contracts for additional buildings are under way. The company will manufacture steel plate products of all kinds and as a special feature will be in a position to metal line their pipe, tanks and other products with zinc, tin, lead, copper and aluminum. This lining will be done by a patented spray process which has been used extensively in Europe for a number of years. A separate department will be assigned to the manufacture of large diameter steel pipe for municipal water supplies. Special equipment will be used here for applying a mineral rubber asphaltum coating for pipe protection. Steel pipe 40 ft. in length will be made.

Charles V. Witt, has been connected successively with the Carnegie Steel Co., the Westinghouse Electric & Mfg. Co., and James McNeil & Bro. Co., with which company he spent 20 years in active management, is president of the new company.

YEOMANS BROTHERS CO., Chicago, manufacturer of pumping machinery and sewage ejectors, has let contracts for an addition to its factory, which will make it 20 per cent larger than at present. It will provide necessary space for additional machinery and assembling operations and also for a complete new testing plant with a capacity of approximately 200 hp.

GENERAL PIPE CLEANING CO., INC., 23rd & Westmoreland Sts., Philadelphia, Pa., announces that it has acquired pipe-cleaning patents and secured the services of experienced operators. It is in a position to receive inquiries for cleaning pipe lines.

HOWARD-COOPER CORP. is now handling Smith mixers in the states of Oregon, Washington, and in the west half of Idaho. It maintains warehouses at Boise, Idaho, Seattle and Spokane, Wash., and Portland, Ore.

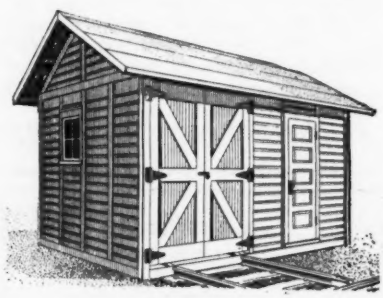
CLIMAX ENGINEERING CO., Clinton, Iowa, announces the appointment of the Maerky Machine Works, 240 Cherry St., Philadelphia, as official parts and service station in the city of Philadelphia and vicinity.

LIEUT. COL. R. W. BERDEAU is in charge of the new dredge and harbor department of the American Brown-Boveri Electric Corp., New York City. The rank was erroneously given in last week's issue as Lieutenant.

New Developments

Sectional Railway Buildings

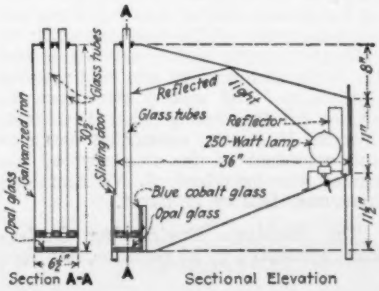
Wooden buildings made up in sectional form for use as railway tool houses, pump houses, track-car sheds, yard shanties, camp structures and for other similar purposes are being manufactured by Sears, Roebuck & Co., Chicago. The material is ready for erection without sawing or nailing, and the only fitting required is for the wainscot or inside sheathing 4 ft. high and the flooring. Fiber board may be placed to form a complete inside sheathing. Walls and partitions are in pan-



els 3x8 ft., with interlocking joints, these panels being solid or with door or window openings as required. Roof panels are 3 ft. wide, and alternative types of roofing may be used. Sills are 3x6-in. and joists 2x6 in., the latter carried in steel stirrups. All wood work is of pine or fir. Hardware fittings are included and also paint for one coat of the finished structure.

New Instrument Detects Turbidity as Low as 0.1

A new instrument, known as a turbidimeter, is being offered by the Levitt-Ferguson Co., Baltimore, Md., for use in determining small quantities of suspended matter in water. It is particularly well adapted for filter plant laboratories, and a turbidity of 0.1 is said to be readily detected. The instrument was invented by John R. Baylis, principal sanitary chemist of the Balti-

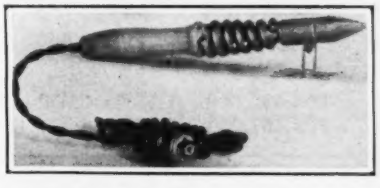


more city water department, and has been in use at the Montebello Filters by him for some time.

The mechanism consists of two glass tubes, one blue cobalt glass and one white glass plate and a 200-ft. projection lamp, the whole placed in a box of galvanized iron painted with black enamel. The accompanying drawing shows the details of construction. One of the tubes is filled with a standard solution whose turbidity is known, while the water to be tested is placed in the other tube. This turbidimeter is for use in testing turbidities less than 2.0 and is not accurate above this amount. Color below 10 does not appreciably affect the results, but if higher than this amount a color determination should be made on the sample and the color of the standard adjusted to approximately this amount.

Electric Soldering Iron

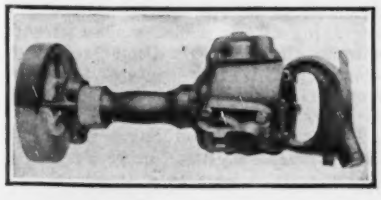
A light-weight soldering iron designed to heat up quickly and made in standard sizes ranging from ½ in. to 1¼ in. tip is a new product of the General Electric Co., Schenectady, N. Y. Power consumption ranges from 70 watts for the smaller iron to 350 watts for the larger size. The irons for heavy duty are provided with radiating stands for the purpose of maintaining the iron at the correct operating temperature when temporarily not in use. Heat from the copper tip is prevented from reaching the handle by means of a spiral made from steel rods. Instead



of the mica usually used as an insulator, the heating unit uses an insulating powder so highly compressed that it becomes a good heat conductor and will withstand temperatures of more than 2,000 deg. F.

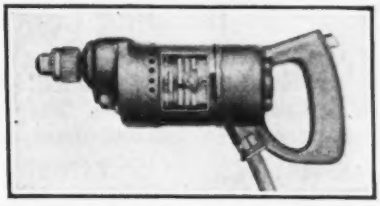
Two New Small Tools

A portable pneumatic grinder and a ¼-in. electric drill are two new products of the Chicago Pneumatic Tool Co., New York City. The grinder is for use on many classes of work where high speed and continuous service is a necessity. It has three cylinders 120 deg. apart, each cylinder provided with its own valve of the piston type. It is designed with especial attention to accessibility for repair. It has a speed of 4,000 r.p.m. and weighs 15½ lb. The



wheel or wire brush is 6 in. in diam. by 1 in. wide.

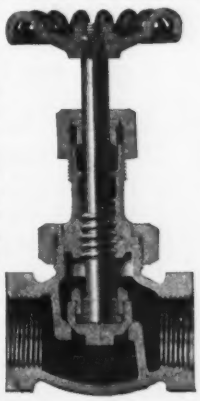
The new ¼-in. electric drill is of the pistol grip type. It is not necessary to hold in the switch. Speeds on d.c. and a.c. are practically the same, and all gears are made of chrome



nickel steel. It also is designed for accessibility, and the entire switch assembly can be removed for inspection and repairs. The net weigh is 6½ lb., and the overall length is 12¾ in. At full load the approximate speed is 1,280 revolutions per minute.

Two-Piece Bonnet on New Line of Valves

A new line of brass valves has been developed by the Ohio Injector Co., Wadsworth, Ohio, which features a two-piece bonnet. Such a bonnet has the advantage of permitting the joint between the body and the bonnet to be made in such a manner that the thread is outside of the seat and thus protected from the action of the fluid passing through the valve. This bonnet construction also greatly facilitates the grinding-in of the valve without removal from the line. A full pipe area at all points and full length pipe threads are claimed for these valves. Flanged-end valves are for steam working pressures up to 150 lb. Screwed-end valves from ¼ to 1¼ in., inclusive, for steam-working pressures up to 225 lb. and from 1½ to 3 in., inclusive, for steam-working pressures up to 200 lb.



New Publications

Incineration.—PITTSBURG-DES MOINES STEEL Co., 905 Curry Bldg., Pittsburgh, devotes its newest booklet to the subject of incineration and a description of its "United States Standard" incinerator, which is a high temperature furnace built into a two-story building. Several views and descriptions of this installation now in use are given.

Pipe Covering—PARAFFINE COMPANIES, INC., 475 Brannan Street, San Francisco, has available a small folder explaining its pipe protective system consisting of a mechanical application of bituminized felt fabrics in a spiral wrapping around pipes. The wrapping machines are portable so that they can be used on the job the pipe immediately being placed in the line.

Arc Welding—GENERAL ELECTRIC Co., Schenectady, New York, has just published a thirty-page booklet called "Arc Welding in G. E. Factories." With many illustrations the booklet describes arc welding procedure under five main heads: Manufacturing and Miscellaneous Processes; Tank Manufacturing; Factory Furniture and Fixtures; Salvage and Repairs; and Structural Steel.

Corrugated Pipe Culverts—ARMCO CULVERT & FLUME MANUFACTURERS' ASSOCIATION, Middletown, Ohio, has reprinted in a 35-page pamphlet, the progress report of a sub-committee of the American Railway Engineering Association on tests of metal and concrete pipe culverts.

Electric Ventilation—AMERICAN BLOWER Co. directs a new bulletin to contractors and electrical dealers, in which is shown the many types of buildings requiring ventilation. Other pertinent information for prospective dealers, together with installation diagrams, are shown.

Gasoline Engines—WAUKESHA MOTOR Co., Waukesha, Wis., in its bulletin No. 5126 devotes 21 pages to describing its various types of industrial power units. Installation drawings, and illustrations are given for a variety of working conditions.

Concrete Mixers—FOOTE CONCRETE MACHINERY Co., Chicago, has just published a catalog and specification book No. 81, describing and illustrating all the major details of its Timken bearing equipped 27-E paver.

Curing Concrete Roads—GRASSELLI CHEMICAL Co., Cleveland, Ohio, has published a second edition of its booklet on "R-B Silicate of Soda for Curing and Hardening Concrete Roads." The booklet gives information and specifications regarding the use, the approximate cost, the advantages and the effect of silicate of soda on the concrete.

Sluice Gates—COFFIN VALVE Co., Neponset, Mass., has just published an 85-page catalog giving descriptive and dimensional information, recommendations and sample specifications for its standard sluice gates. The company is publishing a general catalog covering gates and their operating mechanism for water power and similar projects. This catalog on sluice gates is section No. 1 of the general catalog. It is in effect a textbook on sluice gates.

Elevator Service Motors—GENERAL ELECTRIC Co., Schenectady, N. Y., has issued 2 new bulletins Nos. 405 and 435 describing respectively its constant speed induction motors and its multi-speed induction motors for elevator service. In addition to these, 2 other

bulletins 19B and 416 dealing with inclosed magnetic switches and automatic starting compensators for squirrel cage induction motors are now available.

Roofing—H. H. ROBERTSON CO., Pittsburgh, has issued a small booklet describing its protective metal corrugated sheathing, which consists of corrugated steel covered with successive layers of asphalt and asbestos felt and capped by a heavy waterproofing envelope.

Paint for Steel—TOCH BROTHERS, INC., New York City, has issued a new specification bulletin covering steel preservative paints. The booklet contains information on the company's Portland Cement priming paints, its damp-resisting paints, machine enamel, priming and finishing paints for drinking water tanks, pipe enamel and a number of other paints used on all sorts of steel work.

Buckets, Skips, Pile Drivers, etc., —UNION IRON WORKS, Hoboken, N. J., in a new bulletin No. 63 illustrates and describes its various types of equipment for contractors, railroads and industrial plants. Among the equipment shown are pile drivers, concrete and rock buckets, skips of both wood and steel, grout mixers and ejectors, tunnel shields and air locks.

Centrifugal Pumps — DEAN HILL PUMP CO., Anderson, Ind., devotes bulletin No. 602, to its multi-stage centrifugal pumps. Cross-sections and illustrations of details of the unit supplement the descriptive matter and specification tables.

Swimming Pools—WALLACE & TIERNAN CO., Newark, N. J., has published a booklet entitled "Swim in Drinking Water." The object of the book is to foster interest in the swimming pool movement and to emphasize the necessity of applying the fundamentals of sanitary engineering to the swimming pool. The booklet is a collection of pictures of swimming pools equipped with the company's sterilizers. In the back is a four page list of other installations. A typical plan of a swimming pool with a recirculating system is given.

Automatic Pumping — BARRETT, HAENTJENS & CO., Hazleton, Pa., has issued a 24-page booklet dealing with the automatic operation of centrifugal pumps in which the subject is treated from a purely technical standpoint. The booklet is prepared from a paper by Otto Haentjens and W. A. Cather before the Lehigh Valley Section of the A.I.E.E., at Wilkes-Barre, Pa.

Grab Bucket—HAYWARD CO., New York City, in bulletin 627, describes its buckets for handling sand and gravel. Illustrations are given showing Hayward buckets operated by truck cranes, crawler cranes, locomotive cranes and derricks, besides many special applications. Two pages are devoted to descriptive matter on the various types of orange peel and clamshell buckets available.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Some Demands on Material Markets By Building Contracts Let This Week

FOLLOWING are the values of certain special materials and items involved in this week's building contracts published on pp. 49 to 69 of Construction News. They include awards of industrial buildings to cost $40,000 and more and of other buildings, $150,000 up.

Paint	$475,972	Hardware	$407,976
Glass	781,954	Elevators	2,719,840
Roofings	543,968	Electric wiring	1,121,934
Lighting fixtures	$1,019,940		

This Week's Contracts—Week Ago—Same Week Last Year

THE money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks. Minimum costs observed are: $15,000 for water-works and excavations; $25,000 for other public works; $40,000 for industrial and $150,000 for commercial buildings.

Money Value of Contracts Let—Entire U. S.

Week Ending	Public Work	Private Work	Total Contracts
July 15, 1926	$24,293,000	$43,703,000	$67,996,000
July 8, 1926	36,050,000	32,188,000	68,238,000
July 16, 1925	32,707,000	31,332,000	64,039,000
Heaviest Week			
1926, Mar. 11	13,029,000	73,613,000	86,642,000
1925, Sept. 3	16,215,000	69,424,000	85,639,000
January 1 to date			
1926	593,474,000	965,032,000	1,558,506,000
1925	564,588,000	703,762,000	1,268,350,000

Small Drop in Unfilled Steel Tonnage Considered Favorable

The total output of steel ingots for the entire country, during the first six months of this year, was over 8 per cent ahead of the same period in 1925, according to reports of the American Iron and Steel Institute.

While production has declined steadily since March, 1926, the drop from May to June was about 5 per cent, compared with 7 per cent last year.

Demand, as reflected by unfilled orders on books of the U. S. Steel Corporation, has been decreasing gradually since December, 1925. The decline of 170,608 tons in forward business as of June 30, 1926 compared with orders booked on the last day of May, was considerably smaller than that for the two months preceding, which would indicate a more active market during the past month.

The steady gain in fabricated structural steel bookings since the first of the year was not in evidence during the corresponding period of 1925. At the present rate, this year will be the heaviest in structural steel sales, since 1913.

Calculated monthly ingot production, all companies, for the first six months of this year and last, are as follows:

	1926 Tons	1925 Tons
January	4,150,469	4,193,281
February	3,801,776	3,752 352
March	4,488,362	4,194,340
April	4,123,941	3,583,676
May	3,945,336	3,454,971
June	3,750,653	3,204,451
Six months	24 260 537	22 383 071

Unfilled orders on book of the U. S. Steel Corporation on the last day of each month, for the past six months, are as follows:

	1926 Tons	1925 Tons
January	4,882,739	5,037,323
February	4,616,822	5,284,771
March	4,379,935	4,863,564
April	3,867,976	4,446,568
May	3,649,250	4,049,800
June	3,478,642	3,710,458

Domestic Brick Shipments Gain Despite Foreign Competition

Shipments of common brick from domestic yards are heavier than at the beginning of the season and in greater volume than at this time last year, according to latest reports of the Common Brick Manufacturers Association of America.

Unburned brick on hand, ready for the kilns, are also correspondingly

(*Continued on p. 123*)

June Bond Sales Smallest for that Month During Past Five Years

DISPOSALS of state and municipal improvement bonds during the month of June totaled $134,550,418 according to the *Commercial and Financial Chronicle*. The May issues amounted to $134,854,496 while in June a year ago the placings reached $139,653,772.

During the first six months of 1926 the cumulative total was $709,256,355 compared with $751,838,574 for the same period of 1925; for 1924, $788,744,973; 1923, $584,800,923; and 1922, $655,086,150.

Some of the large awards placed during June were: fourteen issues of 4½s, $7,682,000, Buffalo, N. Y.; $4,000,000 4½s, State of Virginia; $3,812,000 5s, Los Angeles City School District; $3,550,000 5s, Miami, Fla.; $3,507,000 4¾ and 5s, Tampa, Fla.; $3,200,000 4s, Chicago South Park District, Ill.

The accompanying tabulation shows the rates to range from 4 to 6 per cent. Most of the awards called for a premium while a few were placed at par and below. The trend in municipal borrowings is toward reduction in volume.

REPRESENTATIVE PUBLIC BOND SALES, JUNE, 1926

State	Purpose	Amount	Rate per Cent	Sold For	Basis	Dated	Maturity	Purchased by
Colorado	Highway	$1,000,000	5	105.429	4.55	June 1	1943-4	Barr Bros. & Co., Inc. of N. Y. C. and others
Maine	Bridge	500,000	4	100.22	3.97	July 1	1931-40	E. H. Rollins & Sons of Boston and others
Maryland	Roads and bridge	1,800,000	4½	103.64	4.03	June 15	1929-41	Alexander Brown & Sons of Baltimore and others
New Mexico	Road	91,000	6	100	6	.....	1928-30	State of Mexico
County								
Allen, Ind.	Hospital	80,000	4½	.....	....	May 15	1926-45	Fletcher Savings & Trust Co. of Indianapolis
Atlantic, N. J.	Bui'ding	53,000	4½	101.55	4.35	June 1	1928-53	Bankers Trust Co. of Atlantic City
	Road Impvt.	388,000	4½	100.78	4.32	June 2	1927-35	
Blackford, Ind.	Ditch	9,684	6	100.28	5.89	Jan. 15	1927-31	Fletcher American Co. of Indianapolis
Carlisle, Ky.	Road and bridge	200,000	4½	100.09	....	.....	1931-55	Bardwell Deposit Bank of Bardwell
Cape May, N. J.	Road	246,000	4½	100.86	4.39	July 1	1927-44	Hoffman & Co. of N. Y. C. and others
Dallas, Ala.	Court House Annex	50,000	5	101.16	....	July 1	1927-46	Steiner Bros. of Birmingham and others
Edgecombe, N. C.	Road	500,000	4½	100.065	4.496	July 1	1927-66	A. B. Leach & Co., Inc. of N. Y. C. and others
Georgetown S. C.	Bridge	130,000	4½	101.45	....	.....	.....	Stranahan, Harris & Oatis, Inc. of Toledo and others
Greene, Pa.	Highway	375,000	4½	100.76	4.13	June 15	1928-42	Guaranty Co. of New York
Greenup, Ky.	Road and bridge	100,000	5	100.30	....	June 1	1931-50	Weil, Roth & Irving Co. of Cincinnati
Henry, Ky.	Road and bridge	150,000	4½	100.27	4.47	July 1	1931-56	Caldwell & Co. of Nashville
Holmes, O.	Road	6,800	5	100.73	4.68	June 1	1927-31	A. E. Aub & Co. of Cincinnati
Hancock. Tenn.	Road	50,000	5	100.90	4.90	April 15	1936-40	Morris Mather Co. of Chicago
Hillsborough, Fla.	Highway	1,039,000	5	.....	....	June 1	1928-36	Harris Forbes & Co. of N. Y. and others
Jefferson, O.	Highway	26,114	5	101.87	4.55	June 1	1927-35	W. L. Slayton & Co. of Toledo
Maury, Tenn.	Highway	117,000	4½	101.38	4.41	Dec. 1	1949-57	J. W. Jakes & Co. of Nashville and others
Morrow, Ore.	Road	120,000	5	101.77	....	.....	.....	A. D. Wakeman Co. of Portland and others
Ottawa, O.	Road	27,000	5	101.63	4.55	June 1	1927-35	W. L. Slayton & Co. of Toledo
Pottawatomie, Okla.	Road	240,000	4½	102.51	....	Oct. 22	.....	Security Nat. Bk. of Oklahoma City
Sandusky, O.	Road	27,500	5	101.85	4.59	Sept. 20	1927-35	Herrick & Co. of Cleveland
Sanilac, Mich.	Road	53,000	4½	100.80	4.64	July 1	1931-36	Detroit Trust Co. of Detroit
Warren, Tenn.	Highway	77,000	5	101.11	....	.....	.....	Nashville Trust Co. of Nashville and others
Township								
Ashland, Pa.	.....	6,000	4½	100	4½	June 1	1928-31	Clarion Co. Nat. Bk. of Clarion
Delaware, N. J.	Improvement	255,000	..	.....	....	June 1	1932-36	M. M. Freeman & Co. of Philadelphia
Lakewood, N. J.	Sewer	65,000	..	.....	....	June 1	1927-39	M. M. Freeman & Co. of Philadelphia
Municipal								
Arlington, Mass.	Improvement	204,000	4	100.918	....	.....	.....	Kidder, Peabody & Co. of Boston
Albany, N. Y.	Improvement	2,345,000	4½	101.939	4.01	June 1	1927-66	Estabrook & Co. of N. Y. and others
Batavia, N. Y.	Street	90,504	5	.....	....	May 1	1927-36	Hayes & Collins of Buffalo
Bergenfield, N. J.	Improvement	574,000	4½	100.35	4.64	June 15	1927-31	J. B. Van Ingen & Co. of N. Y. and others
Birmingham, Ala.	Improvement	250,000	4½	100.67	4.35	July 1	1927-36	Gibson, Leefe & Co., Inc. of N. Y. C.
Bloombury, N. J.	Water	55,000	4½	100.36	4.48	July 2	1928-65	Citizens Nat. Bk. of Bloombury
Boone, Iowa	Sewage disposal plant	110,000	4½	100.10	....	.....	1927-46	George M. Bechtel & Co. of Davenport
Buffalo, N. Y.	Improvement	7,682,000	4½	101.609	4.07	June 15	1927-56	Guaranty Co. of N. Y. and others
Crosby, N. D.	Water and sewer	40,000	5½	101.50	....	.....	.....	Drake-Jones Co. of Minneapolis
Concord, N. H.	School	160,000	4½	100.96	....	Dec. 1	1927-65	Merrill, Oldham & Co. of Boston
Clementon, N. J.	Water	191,000	5	102.46	4.72	June 1	1928-66	Clementon Nat. Bk. of Clementon
Denison, Tex.	School and street	200,000	5	101	4.87	May 1	1927-46	C. W. McNear & Co. of Chicago
Duluth, Minn.	Water and light	1,000,000	4	99.319	4.085	July 1	1927-46	First Nat. Bk. of N. Y. C. and others
Danville, Va.	Improvement	323,000	4½	99.75	4.53	July 1	1926-50	Braun, Bosworth & Co. of Toledo
Dexter, N. Y.	Water and sewer	150,000	4.40	100.279	4.39	June 1	1930-59	R. F. DeVoe & Co. of New York
Evanston, Ill.	Improvement	95,000	4½	102.39	4.21	June 1	1927-46	Halsey, Stuart & Co. of Chicago
Fall River, Mass.	Improvement	150,000	4	100.21	3.96	June 1	1927-36	R. L. Day & Co. of Boston
Flint, Mich.	Improvement	333,467	5	100.51	4.43	May 12	1927-28	Detroit Trust Co. of Detroit
Gastonia, N. C.	Improvement	225,000	4½	100.19	4.73	May 1	1927-66	Seasongood & Mayer of Cincinnati

Domestic Brick Shipments Gain

(*Concluded from p. 122*)

greater in number. Orders on books, however, show a decline, especially when compared with a year ago.

Foreign made brick, according to the Bureau of Foreign and Domestic Commerce have already penetrated Maine, New Hampshire, Vermont, New York, Maryland, Florida, North Dakota and Washington.

The average price at 103 yards throughout the country, was $11.37 to $15.65 per M. as of June 1, 1926, compared with $11.33 to $15.65 at 110 yards, May 1, 1926 and $11.12 to $16.18 per M. at 122 yards, June 1, 1925.

COMMON BRICK MOVEMENT

	Burned Brick on Hand M.	Brick Moved from Yards During Month M.	Orders on Books M.
June 1 1926	250,849	192,065	265,435
May 1 1926	265,093	146,431	277,412
June 1 1925	239,389	180,851	333,967

Lumber Movement Substantially Ahead of a Year Ago

A total of 6,891,855,179 ft. of lumber was produced by the eight regional divisions of the National Lumber Manufacturers Association, during the first twenty-six weeks of 1926. This is compared with 6,615,472,057 ft. for the corresponding period last year, a gain of 4 per cent for the 1926 cumulative total.

Shipments on old orders and new demand are both heavier than for the period Jan. 1 to July 4, 1925.

The slight excess in volume of both shipments and orders over that of production, serves to offset the present tendency to accumulate unfavorable inventories at dealers' yards throughout the country.

The following tabulation shows the national softwood lumber movement for the first twenty-six weeks, this year and last:

	PRODUCTION Ft.	SHIPMENTS Ft.	ORDERS Ft.
1926	6,891,855,179	7,044,698,799	7,010,906,651
1925	6,615,472,057	6,652,498,215	6,438,348,460

This Week's Special Tabulation of Unit Prices

9. Earth Excavation

The following unit prices are included in the low bidders' estimates on various state highway projects:

Location	Date	Cu.Yd.	Price per Cu.Yd.
Missouri	July 1922	5,000	.60
Kentucky, Proj. 76	Aug. 1922	27,313	.50
Vermont	Sept. 1922	19,376	.95
Utah	Oct. 1922	4,416	.80
Texas	Jan. 1923	27,000	.50
Kentucky, Proj. 86A	Apr. 1923	59,709	.47
Kentucky	Sept. 1923	88,400	.52
California	Dec. 1923	59,000	.81
New York, Hy., No. 8156	Feb. 1924	190,000	.80
Idaho	May 1924	45,815	.40
Kentucky	Aug. 1924	16,500	.55
Idaho	Jan. 1925	68,311	.30
Oregon	Jan 1926	44,000	.23
Idaho	Mar. 1925	89,729	.79

Weekly Construction Market

CONCRETING materials, lime, brick and the clay products remain firm throughout most of the principal cities. There is considerable fluctuation in linseed oil, with Minneapolis and New York prices remaining unchanged during the week. The two most important materials in the current market, from the standpoint of price trend, are steel and lumber. The former shows considerably active demand for reinforcing bars, shapes and plates, also railway and automotive material. Pig-iron buying, recently slow, has accelerated appreciably, particularly in the Middle West. The scrap market continues sluggish. The published quotations of $2 per 100 lb., Pittsburgh mill, on bars and shapes, still holds; $1.90 per 100 lb., however, is mentioned on these and plates. Telegraphic reports to the Lumbermen's Bureau at Washington, show yellow pine prices weak in the Hattiesburg, Ala. and Cincinnati districts, with a declining trend in Jacksonville, Fla. New York and Chicago markets are unchanged. St. Louis reports fairly good demand, while firmness prevails at Buffalo, N. Y. The average mill price of Douglas fir is $26.33 per M. ft. as against $27.37 at this time last year. Mill price of pine averages $32.08, compared with $32.24 per M ft. in July, 1925. Among the principal labor developments of the week are the strike of electrical workers in St. Louis and that of hod carriers and plasterers' helpers, at New Haven. The former demand closed shop conditions and the New Haven men, an advance of 10c. per hr. over the present schedule of 65c. for the hod carriers and 75c. for plasterers' helpers. Boston cement finishers returned to work at a rate of $1.25 per hr., after having been on strike since April 1. A considerable number of Kansas City carpenters have also returned at the new scale of $1.25 per hr.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	$3.40	$4.15	$3.10	$3.35	$3.07½	$3.30	3.35	$4.00
Structural rivets, 100 lb.	4.50	3.50	4.75	3.50	3.75	4.65	5.00	4.00	5.50
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.30	3.38	2.60	3.25	3.77½	2.95	3.25	3.25
Steel pipe, black, 2½ to 6 in. lap, discount	48%	54%	53.6%	55%	54.25%	36%	35.6@49.2%	45%	37.83
Cast-iron pipe, 6 in. and over, ton	51.60@53.60	+47.50	54.00	49.20@50.20	53.00	64.00	50.00	55.00	55.00
Concreting Material									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.10	2.32	2.85	2.31	2.65	1.15
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	1.60	1.65	1.90	1.80	1.50	1.50
Sand, cu.yd.	1.00	1.60	2.00	1.40	1.25	1.00	1.40	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.50	2.83	1.87½	1.75	2.50	1.70	3.00	1.70
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	62.00	34.00	56.00	40.50	38.25@38.75	34.75	27.00	23.00	55.00
Lime, finishing, hydrated, ton	18.20	23.50	+20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.10@3.00	1.50	1.85	2.25	1.60@1.70	2.70	1.60	2.80	10.00
Common brick, delivered, 1,000	20.40	10.50	14.10	12.00	13.75	12.00	15.00	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	0895	.112	.075	.076	.075	.....	.09	.12
Hollow partition tile 4x12x12, per block	.1112	.0895	.112	.075	.076	.075	.108	09	10
Linseed oil, raw, 5 bbl. lots, gal.	.89½	— 96	1.13	+.91	.97½	1.13	.97	1.12	1.03
Common Labor									
Common labor, union, hour	.90½	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.82½	.45@.60	40@.45	.50	.50	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent. L.c.l. is less than carload lots.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime in 280-lb. bbl. net and hydrated lime, f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Reinforcing bars (billet steel) and shapes delivered to job in less than carload lots.

Labor—Concrete laborers' rate, 93¾c.; building laborers, 90¾c.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone f.o.b.; price on fir is quoted instead of pine. Reinforcing bars (billet steel), f.o.b. in carload lots; shapes, l.c.l.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. Bars (billet steel) and shapes, less than carload lots.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net. Bars (billet steel) and shapes, l.c.l.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net. Bars (billet steel) and shapes, l.c.l.

Dallas quotes lime per 180-lb. bbl. Cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered. Bars (billet steel) and shapes, l.c.l.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C.-I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common. Bars (billet steel) and shapes, l.c.l.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers. Bars (billet steel) and shapes, l.c.l.

Montreal quotes on fir lumber. Sand, stone, gravel and lump lime per ton. Stone and tile are delivered; sand, gravel, lime and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 100.12). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½ in., $37.83. Bars (billet steel) and shapes, l.c.l.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of July 1 the next on Aug. 5.

Business Briefs

Call money quoted at 4½ per cent, July 12; year ago 5 per cent.

Time loans: Sixty-ninety days, 4⅜@4½; four-six-months, 4½ per cent.

Commercial paper: Best names 4 per cent; other names, 4¼ per cent.

On July 1, 1926

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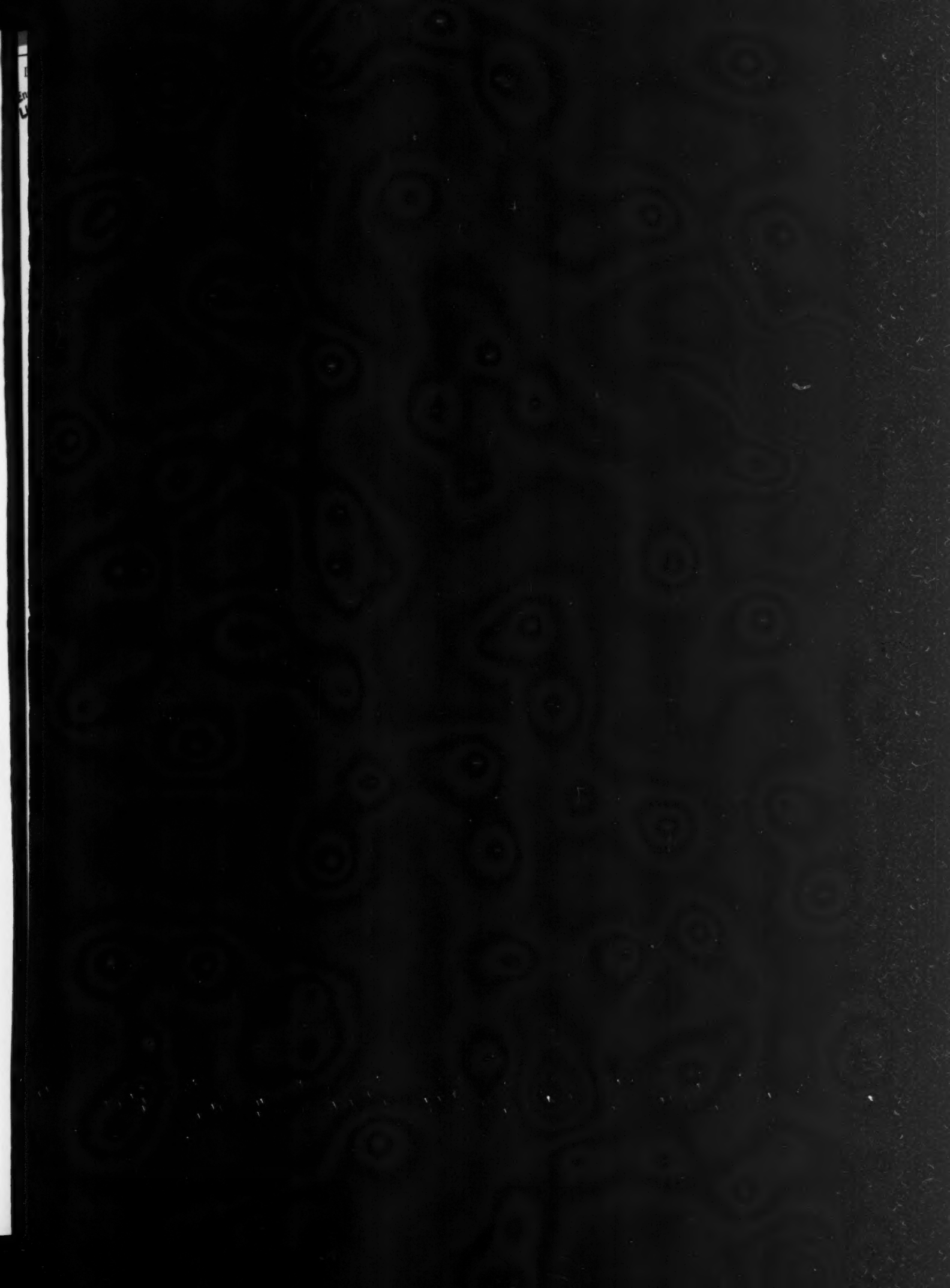
For Explanation and Details of Indexes Since 1913 See the First Issue of Every Month